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An Evaluation of Cavity Preparations in Primary Molars

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INTRODUCTION

MOST dentists agree that silver amalgam is the filling material of choice when restoring proximo-occlusal cavities in primary molar teeth. However, because of differences in regional teaching individual ability and experiences, dentists have not been in complete agreement regarding the form of the cavity in which the silver amalgam is to be placed.

The principles of cavity preparations being used in primary teeth today are largely those which were advocated by Dr. G. V. Black for use in permanent teeth. According to Black, "The term cavity preparation is applied to that mechanical treatment of dental caries and other diseases and injuries of the hard tissues of the teeth, as will best fit the remaining part of the tooth to restore it to its original form, give it strength, and prevent recurrence of decay in the same surface" (1).

In order that a cavity preparation may fulfill these requirements, special consideration must be given to outline form, resistance form, retention form, and convenience form.

Because of the anatomical and histological differences between permanent and primary teeth, the forms used in cavity preparations for permanent teeth must be modified slightly when used in primary teeth. However, for the most part the same principles that Dr. Black advocated have been adhered to and are used in the preparations of the primary teeth.

A common observation of dentists who include children in their practice is that there are still too many failures of the Class II type of silver amalgam restorations placed in primary molars. These failures may be the result of many factors. Many are caused by an improper operative technic on the part of the dentist, insofar as the present teachings of cavity preparation, matrix adaptation, condensation of amalgam, and finishing, guide us. Dr. R. I. Ireland states that the most common errors of this type are:

1. Buccolingual preparations at the junction of the proximal and the occlusal portions that are too narrow.
2. Inadequate preparation of the occlusal step. In many preparations, there is no attempt to do more than "scoop" out the carious dentin.
3. Extreme tapering toward the buccal and toward the lingual aspect of the walls of the proximal preparations" (2).

Other failures may be attributed to lack of patient cooperation in that they may place excessive force on the restoration within the first few hours following dismissal. Another common failure may be seen in the restoration which has a line of fracture across the area of the isthmus. The fracture line generally occurs after the restoration has been in the tooth a few weeks or months. It is with this latter type of failure that this investigation is concerned.

It was the purpose of this investigation to test and evaluate those principles which are already being used in cavity preparations for the Class II silver amalgam restoration in primary molars, and to suggest those principles which according to results of tests would be advantageous to be included in a cavity preparation of this type.

Many research projects have been reported (3, 4, 5, 6) regarding the physical properties of silver amalgam. However, we were unable to find a single report of a study where the various mechanical principles of cavity preparations were tested to determine which principles were the most desirable to include in a proximo-occlusal cavity prepared in a primary molar to receive a silver amalgam restoration.

Although there are at present several different types of cavity preparations being used in different areas of the country, it would seem desirable to have a standard cavity form for the incipient Class II silver amalgam restoration in a primary tooth. This cavity preparation should provide for maximum resistance to fracture and other common failures of the silver amalgam restoration minimum injury to the tooth tissues and be capable of being prepared in a reasonable length of time.

Review of the Literature

Under the subheading of "Treatment of Caries of the Deciduous Teeth," Dr. G. V. Black said, "This is one of the most difficult subjects in dentistry.... We may place fillings in these teeth just as well as in adult teeth; there is nothing in the condition of the tissues of the teeth that will hinder making these fillings, and if the extensions are made sufficient to protect the area of liability to decay, fillings will stand well. The technical procedures in making fillings in these teeth would be the same as in making like fillings in the teeth of adults and will not be discussed. However, the general rule is that we can not make metallic fillings for the little folk; we will have to resort to other methods" (7). Dr. Black later goes on to say, "Of course, where we can control the child to prepare the cavities and make fillings, even though we can not make much extension, it is still the better method to make fillings rather than cut away the surfaces and for this purpose I should say that there is nothing better than a good amalgam filling, if well put in and polished properly afterwards."

Various reports (8, 9, 10, 11, 12, 13) since this time have shown that a cavity in a primary molar, prepared to receive a proximo-occlusal silver amalgam restoration, should be based upon at least four fundamental factors. These factors are:

1. A consideration of the morphology of the primary tooth involved.
2. A knowledge of the mechanics of external forces and internal stresses.
3. A complete understanding of the physical properties of silver amalgam.
4. Be relatively simple to secure.

These four factors will be enlarged upon in the following paragraphs. First, it must take into consideration the morphology of the primary tooth involved.

a. The pulps of primary teeth are larger in comparison with the size of the crowns, than those of the permanent teeth.
b. The horns of the primary pulp extend for a greater distance into the crowns of the primary teeth than is commonly the case in permanent teeth.
c. The enamel and dentin of primary teeth are thinner than those of the permanent teeth.
d. The enamel rods in the gingival

third of the primary teeth extend from the dentino-enamel junction, occlusally or incisally.

We would also know that we can expect to find a pulpal horn under each cusp; that the mesial pulpal horns of the primary molars are higher than the distal pulpal horns; and that the pulp chambers of the mandibular molars are usually larger than the pulp chambers of the maxillary molars.

Second, it must be based upon a knowledge of the mechanics of external forces and internal stresses.

Force is any condition that alters a body's natural state of rest or of uniform motion in a straight line. The three elements that must be known before a clear notion of the force of mastication can be understood are: (1) its plane of application; (2) its direction, and (3) its magnitude. The study of dynamics treats of the action of force, as divided into two classes, kinetics and statics.

Impact, or kinetic force, which may result from the process of mastication, consists of forces applied suddenly or with velocity to the teeth or restoration.

Static, or steady loads, are forces that exert gradual, steady pressure on the teeth or restoration in proportion to the value of the force itself. Static central loads may be produced by compressive, tensile, or shearing stress. During the process of mastication all three kinds of stress may be utilized, the compressive in crushing and grinding, the tensile for sticky foods and candy, and the shearing, by the anterior teeth and the cusps of the posterior teeth, during lateral excursions.

A knowledge of the resistance of dental materials to the forces of mastication is an important factor in the selection of materials for dental restorations.

When forces act on a body in equilibrium, they do more than hold it in a state of rest. They deform it and set up in it forces opposing the deforming forces. The term load is frequently applied by engineers to the force acting on a body from the outside while the forces within that body which oppose the applied forces are known as stresses. However, the term stress is frequently used for load. The deformation, which means the change of any linear dimension of the body, is referred to as strain.

Materials used for restoring teeth are called upon to sustain forces applied to them repeatedly for short periods of time as contrasted to those which sustain continuously applied forces. Materials subjected to repetition of small stress will fail much sooner than if subjected to an equal continuous stress. The greater the range of stress variation the fewer the repetitions or cycles of stress before failure. If the stress changes direction, for example, changes from compression to tensile and back in each cycle, failure will result in fewer cycles than if it varies only in compression. The failure resulting from a great number of repetitions of stress is called the endurance limit of the material.

Abnormal stress created by external force rather than over-load is the destructive factor of short span restorations.

In a recent study of cavity preparations using Photoelasticity and polarized light, Noonan (12) made three conclusions from his data and they seem to be significant here. They are:

1. A flat floor permits less stress concentration than one which is rounded. However, in the flat based restorations studied, the maximum stress was approximately 20 per cent greater at the corners than at other points on the base.
2. A rounded angle permits less stress concentration than a sharp angle.
3. Retention points should not be sharp

but rounded to decrease stress concentration.

Third, we must have a complete understanding of the physical properties of silver amalgam.

Silver amalgam is a combination of mercury with a metallic alloy usually manufactured in the form of fine fillings. When properly manipulated, the amalgam plug expands slightly in the process of setting or hardening. Simple laboratory tests determine that amalgam is strongest in compression, next in shear, and weakest in tension. Whenever one uses amalgam it becomes a problem to prepare the tooth so that the favorable compressive property of the amalgam is utilized to its fullest advantage while the filling is protected against the forces of shear and tension. Furthermore, for permanence, the cavity preparation must be designed to retard flow.

It must be remembered that silver amalgam has its strength in bulk.

Fourth, a successful operator recognizes that operative technics for a primary molar involve the management of a young child patient and the collection of a fee. Hence a mechanically sound cavity preparation, in order to be of practical value, should be relatively simple to secure.

A review of the literature indicates that many mechanical principles were either being included or excluded from proximo-occlusal cavity preparations in primary molars, in different areas of the country for different reasons.

Rabinowitch states (14) that in ideal preparations, added retention may be obtained through the use of angle formers placing the point at the gingival-axial line angle moving bucco-lingually thereby creating a slight undercut. He mentions that bulk of material is obtained in one of two ways, either by depth or width. In the primary teeth, because of the size of the pulp, the cavity is extended high on the cusps providing bulk of material through width.

Brown states (15) that the isthmus in the occlusal plane of the cavity creates two centers from which expansion radiates, and subsequent tension results across this area, hence the pulpal-axial line angle is rounded to reduce stress concentration on this line. Brown also states that the pulpal floor must always be flat.

Sweet believes (16) that if additional bulk of filling material is deemed necessary, a deeper cut is made in the central portion of the step with a No. 35 inverted cone bur in primary second molars. This cut should be the exact width of the cutting blades and one-half their depth. This step within the occlusal step will not endanger the pulp of the tooth. He also says, "It must be emphasized that the occlusal step should attain the maximum width possible where it joins the proximal portion of the cavity preparation."

Simon states (17) "A retentive resistance form must be cut into the bucco-axial and linguo-axial line angle. These retention forms are created with a 700 cross-cut fissure bur or with a 000 single cut fissure bur.

Ireland mentions (2) the importance of a retentive or "U" groove on the gingival floor near the axial gingival line angle.

Methods and Materials

A review of the literature indicated that there was a definite need for research on the relation of cavity form to failure of compound silver amalgam restorations in primary molar teeth. Therefore, considerable time was allowed to investigate the best methods of approaching the problem and materials to be used. Constant consideration was given to determining and eliminating all possible variables. Answers

to the following problems had to be determined before progressing to the final tests.

(1) Which principles of Class II cavity preparation should be tested?
(2) What material should be used for the teeth in which test preparations were to be made?
(3) How could adequate matrix adaptation be obtained?
(4) What method of condensing amalgam should be used?
(5) What type of a testing machine or device should be used?
(6) How long should the amalgam be allowed to set before conducting the tests?
(7) How should statistics and charts be made?

In determining the mechanical principles to be tested, certain factors which have been advocated and accepted by most authors on the subject were used as constants throughout the entire investigation. The constants were: (1) that the preparation should be based entirely upon dentin, and that one could penetrate at least one millimeter deep in any area of a primary molar tooth without fear of exposure; (2) the buccal and lingual cavo surface angle at the proximal, should flare sufficiently to carry the margins into free cleansing areas and yet maintain a 90 degree cavo-surface angle; (3) the area at the buccal gingival and lingual gingival line angle of the proximal box should be gently rounded; (4) the depth of the gingival floor should be carried just below the level of the gingiva and below the contact of the approximating tooth, and (5) the walls of the proximal box should converge slightly as they approach the occlusal.

The following are the principles of the Class I cavity preparation which it was determined should be investigated.

1. Narrow isthmus (Figure 6) (The width of the isthmus was approximately one-sixth the buccal lingual dimension of the second primary molar).
2. Wide isthmus (Figure 9) (The width of the isthmus was approximately one-fourth the buccal lingual dimension of the second primary molar).
3. Sharp pulpal axial line angle (Figure 6) (The pulpal floor joins the axial wall at a right angle.)
4. Flat pulpal floor (Figure 6).
5. Gingival retentive groove (Figure 7) (This groove is referred to as a "U" groove by some dentists. However, this term is sometimes confused by those who think of the "U groove" as a groove extending along the gingival-axial line angle, and also a short distance along the bucco-axial and linguo-axial line angle.)
6. Side retentive grooves on buccal and lingual wall of proximal box (Figure 8 (The grooves tested differ from bucco-axial and linguo-axial retentive grooves in that they extended the entire length of the wall.)
7. Rounded pulpal-axial line angle (Figure 12) (The curvature is equal to one-fourth the circumference of a No. 2 bur, when the principle is used on an actual size tooth.)
8. Rounded pulpal floor with a rounded pulpal axial angle (Figure 18) (The rounded part did not extend along the entire pulpal floor. The curve started very shallow at approximately two-thirds of the distance from the pulpal axial line angle to the most distal part of the preparation, and increased to full depth at the pulpal axial line angle. When applied to an actual size second primary molar, the depth of the curve used was equal to one-half the

diameter of a No. 4 Bur. The pulpal axial line angle was then curved as was in principle #7.)

The second factor considered was materials to be used for the teeth in which cavity preparations were to be made. It was decided to use a lower second primary molar. Three teeth were carved in wax. One was actual size according to Dr. G. V. Black's measurements, another was two-dimensional and a third was three-dimensional. Acrylic teeth were first processed from the model wax teeth. Mesial Class II cavity preparations were then made in the acrylic teeth. The cavity preparations were then filled with silver amalgam in a manner which will be described later. From these tests it was determined that the two-dimensional tooth would be the most satisfactory. Therefore another two-dimensional tooth was carved out of a dental stone material, and served as a master model for all of the teeth used in the investigation.

A rubber mold was made from the master model. Several wax teeth were then made by pouring melted wax into the rubber mold. Acrylic teeth were made by making dies of the wax teeth, and then processing acrylic in the dies. Cavity preparations employing some of the different mechanical principles were then made in the acrylic teeth. These tests showed that the acrylic teeth would not hold up or remain constant in shape and contour during a large series of tests. The margins of the acrylic teeth were easily chipped, and it was difficult to remove the fractured segments of silver amalgam.

Models made by copper-plating impressions, and models made from Dee's metal (low fusing metal) were also tried and proved to be unsatisfactory. Models were then made of brass, and tests indicated they would be very satisfactory.

Using the rubber mold of the master model, two teeth were made out of dental stone. A cavity preparation was then made in each stone tooth. Since the teeth were two-dimensional, each measurement of depth and extension was two times the measurement which could be safely employed in an ideal Class II cavity preparation in a primary molar. The two preparations were similar in that they both included all of the constant principles previously mentioned, with a flat pulpal floor, and a sharp pulpal axial line angle; they were dissimilar in that one had a narrow isthmus (Figure 6), and the other had a wide isthmus (Figure 9). A rubber mold was then made from each of the dental stone teeth. Nine wax teeth were then made from each of these two dissimilar rubber molds. Using these wax teeth as patterns, nine brass teeth were cast for each of the two groups. The various principles to be tested were added to the brass teeth in groups of three, so that there were three identical brass teeth for each mechanical principle to be tested (Figure 1). The teeth were set up and numbered as follows for the first series of tests.

Group I Narrow Isthmus	*Group II Wide Isthmus*
NP1	WP1
NP2	WP2
NP3	WP3
NU1	WU1
NU2	WU2
NU3	WU3
NS1	WS1
NS2	WS2
NS3	WS3

Explanation of symbols:

N—Narrow isthmus

W—Wide isthmus

P—Plain, or a tooth with only the constant principles, and flat pulpal floor. Those constant principles included were: (1) that the preparation should be based

entirely upon dentin, and that we could penetrate at least one millimeter deep in any area of a primary molar tooth without fear of exposure; (2) the buccal and lingual cavo surface angle at the proximal, should flare sufficiently to carry the margins into free cleansing areas; (3) the area at the buccal gingival and lingual gingival line angle of the proximal box should be gently rounded; (4) the depth of the gingival floor should be carried just below the level of the free ginginva and below the contact of the approximating tooth, and (5) the walls of the proximal box should converge slightly as they approach the occlusal.

U—Teeth number p plus the gingival retentive groove.

S—Tooth number p plus the side retentive grooves.

1—Sample #1 of each combination.

2—Sample #2 of each combination.

3—Sample #3 of each combination.

It should be noted that no attempt was made to use a material which approximated the physical properties of the natural tooth. The aim of the project was not to test the cavity preparation in a natural tooth, but to merely test the mechanical principles involved, on a comparative basis. Therefore it was felt the material used for the teeth was not as important as the fact that all mechanical principles should be tested in the same material under identical conditions.

After testing bases for the brass teeth made out of Dee's metal, dental stone, and extra hard dental stone (Duroc), it was determined that Duroc bases would be the most practical and hold up the best throughout the series of tests. The bases were approximately 2 inches square and ¾ inches thick, with a depression made in them which was the shape of the root part of the brass teeth (Figure 2).

After trying several types of matrices,

FIG. 1

a two pieced brass matrix made to fit on each side of the tooth and held together by a clamp was selected (Figure 3). This matrix provided a non-moveable, constant type of matrix. It also kept the "bulk of material" in the proximal box constant.

The silver alloy used in these tests was made by Minimax and proportions for both the filings and the mercury were weighed on a five to eight basis and stored in gelatin capsules. The silver alloy and mercury were mixed in a Crescent Wig-L-bug (Figure 4) for 10 seconds and the mercury was expressed in linen squeeze cloths.

A mechanical condensing instrument holding a large proximal box point was used to condense the silver amalgam into the cavity. When the cavity had been filled to excess a rubber tipped condensing point was used to aid in removing any additional mercury from the restoration.

FIG. 2

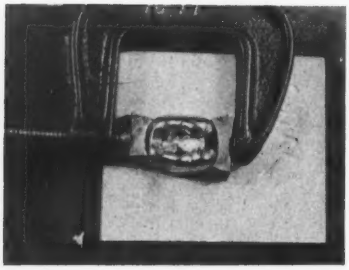


FIG. 3

The restoration was then carved to a constant occlusal form by the use of specially designed carvers and a master occlusal pattern check block. A one speed motor was used to run the condensor. It was here that a variable remained as exerted pressure was only as constant as could be gauged by the same operator.

After considerable study as to the best method of testing the silver amalgam restorations placed in the brass teeth it was decided that a device which could produce a controlled, directed and measurable force of impact would be necessary.

The frame of the impact tester (Figure 5) was made from the frame of a denture flask press. A soft metal bearing was added to the screw ring in the top, and a steel shaft was made which could be dropped through this hole, thus creating a wide oilless bearing of a soft metal against a hard metal. The steel shaft was tapered at the lower end so that it ended in a rounded point which would be similar to the cusp of a tooth. An adjustable piece of metal was attached to the lower part of the shaft, in order to control the distance the shaft was dropped. A release lever and automatic counter was attached to the frame, and a base of Duroc was added. Control screws, to adjust the base holding the brass teeth, were imbedded in each one of the four sides of the Duroc base of the frame. Removable metal discs were placed between the control screws and the Duroc base to prevent chipping of the base.

The brass tooth, with the amalgam restoration placed in it, was then placed in the proper Duroc base. The tooth and

FIG. 4

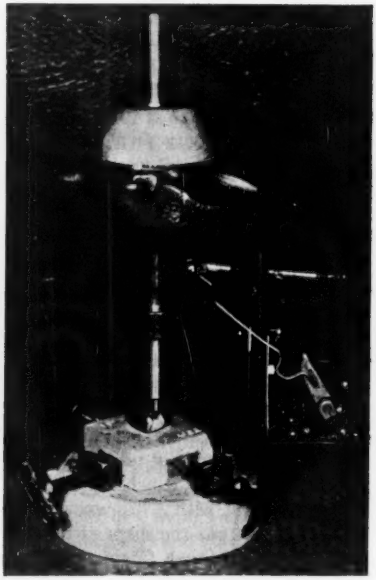
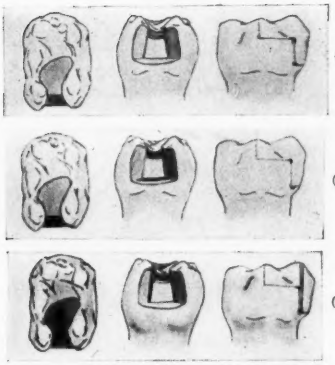


FIG. 5

Series I

Group I



Group II

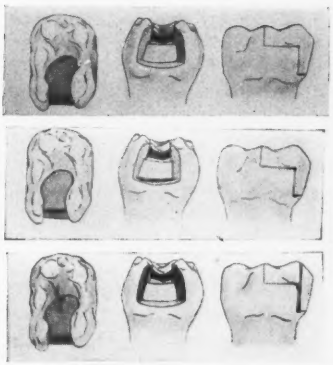


FIG. 6. (NP) Narrow isthmus—plain preparation.

FIG. 7. (NU) Narrow isthmus—"U" groove added.

FIG. 8. (NS) Narrow isthmus—side retention grooves added.

FIG. 9. (WP) Wide isthmus—plain preparation.

FIG. 10. (WU) Wide isthmus—"U" groove added.

FIG. 11. (WS) Wide isthmus—side retention grooves added.

base were then placed approximately on the center of the impact tester base. The shaft was lowered carefully so that the rounded point would rest normally on the restoration at a point directly above the isthmus of the cavity preparation, and at a point midway between the buccal and lingual margins of the restoration. The removable metal discs were then placed between the tooth base and the four control screws, and the tooth base was locked into position. The shaft was then lifted with one hand to its upper lock position, and the counter set at zero, and the release lever was pulled with the other hand, allowing the shaft to drop freely against the previously set point of contact on the restoration. This action is referred to as the impact. This complete cycle was repeated until the restoration fractured, and the impacts were automatically counted. The number of impacts was recorded on a chart. The procedure was then repeated on other restorations until the entire group had been fractured. After the restorations in all nine teeth of both groups had been tested, the fractured segments of the silver amalgam which remained in the teeth were removed and the teeth were ready again to be filled.

The period of setting time for the amalgam, between condensation and testing, was determined after testing samples which had been allowed to set 12 hours, 24 hours, 48 hours, and 96 hours. Using identical samples, the following are the average figures obtained.

Hours	*Number of Impacts to Cause Fracture*
12	69
24	96
48	127
96	178

Because of convenience, it was decided to use a setting or waiting time of 48

Series II

Group I

(12)

(13)

(14)

Group II

(15)

(16)

(17)

FIG. 12. (NP) Narrow isthmus—plain preparation.

FIG. 13. (NU) Narrow isthmus—"U" groove added.

FIG. 14. (NS) Narrow isthmus—side retention grooves added.

FIG. 15. (WP) Wide isthmus—plain preparation.

FIG. 16. (WU) Wide isthmus—"U" groove added.

FIG. 17. (WS) Wide isthmus—side retention grooves added.

hours between the time the teeth were filled and tested.

DISCUSSION

The illustrations in Figures 6 to 23 indicate the manner in which the teeth were placed in Groups I and II, and also in Series I, II, and III for tabulating the results on the charts.

The cavity preparations in Series I contained all of the constant principles, plus a plain pulpal axial line angle. The cavity preparation in Group I had a narrow isthmus, while those in Group II had a wise isthmus.

The cavity preparations in Series II are identical to those in Series I except that the pulpal axial line angles have been rounded.

The cavity preparations in Series III are identical to those in Series II except that part of the pulpal floor and the pulpal axial line angle have been rounded.

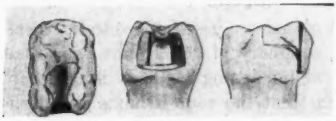
As indicated on Chart I, the teeth were divided into two groups for the first series of tests: Group I had a narrow isthmus, and Group II had a wide isthmus. All of the teeth of Group I (test 1) were filled at one work period. The silver amalgam restorations were allowed to set for forty eight hours before being tested by the impact tester. While the restorations were being tested, careful attention was paid to note the first evidence of fracture of the restoration. As soon as each restoration fractured, the number of impacts registered on the automatic counter was recorded. The same procedure was repeated for Group II (test 1). The silver amalgam which remained in the brass teeth was removed. Care was taken so that neither the margins nor shape of the

Series III

Group I

(18)

(19)



(20)

Group II

(21)

(22)

(23)

FIG. 18. (NP) Narrow isthmus—plain preparation.

FIG. 19. (NU) Narrow isthmus—"U" groove added.

FIG. 20. (NS) Narrow isthmus—side retention grooves added.

FIG. 21. (WP) Wide isthmus—plain preparation.

FIG. 22. (WU) Wide isthmus—"U" groove added.

FIG. 23. (WS) Wide Isthmus—side retention grooves added.

cavity were changed in any way. The cavities were now ready to be filled again. This completed the first test. This entire procedure was repeated four more times, making five tests in all. The five tests completed the first series.

It may be noted from Chart I that Series I contains the results of testing the Plain Pulpal Axial Line Angle in conjunction with the Gingival Retention or "U" Groove, and with the Side Retention Groove. Since there were three identical samples of each principle tested, and each sample was tested five times, each principle was actually tested fifteen times. It will be noted from the chart that the numbers were averaged from left to right and from top to bottom. A total average was then made of all the sub-totals and is indicated at the right side of the charts. This number in the "Total Av." column will be referred to later when discussing the number of impacts required to fracture the restoration in each different tooth.

We were now ready for the second series of tests. Therefore, the teeth were prepared in the following manner:

The Pulpal Axial Line Angles of the nine teeth in each of the two groups were rounded so that the angle was equal to one fourth the circumference of a No. 4 bur. This would make the pulpal-axial line angle equal to one fourth the circumference of a No. 2 bur in a primary molar of actual size.

The tests were repeated for the second series in the manner as was previously described for the first series.

The teeth were prepared for the third series of tests in the following manner:

The pulpal floor was rounded. The curve started very shallow at approximately two thirds of the distance from the

pulpal axial line angle to the most distal part of the preparation, and increased to full depth at the pulpal axial line angle. The full curve was equal to one-half the circumference of a No. 8 bur. When applied to a primary molar of actual size, the depth of the curve used was equal to one-half the diameter of a No. 4 bur, or equal to a depth of one-half millimeter. The pulpal axial line angle was then curved as it was for Series II.

The tests were repeated for the third series in the same manner as was previously described for Series I and II.

An X appearing above a number on the charts indicates that the first test was faulty. The number listed in the number of impacts required to fracture the restoration when a second test was made.

An explanation of symbols used in the charts under "Tooth Designation" is as follows:

N—Narrow isthmus

W—Wide isthmus

P—Plain, or a tooth with only the constant principles.

U—Tooth number P plus a gingival wall retention groove.

S—Tooth number P plus the side grooves, or occlusal to gingival grooves on the buccal and lingual proximal walls.

1—Sample #1 of each combination.

2—Sample #2 of each combination.

3—Sample #3 of each combination.

Series I refers to the series of tests which included the principles of a flat pulpal floor, and a plain pulpal axial line angle.

Series II refers to the series of tests which included the principles of a flat pulpal floor, and a rounded pulpal axial line angle.

Series III refers to the series of tests which included the principles of a rounded pulpal floor, and a rounded pulpal axial line angle.

The results of the tests are tabulated in Charts I to VI, and in the graphs of Charts VII to XIII.

Percentage increase in resistance to fracture was figured as follows:

The number of impacts in the column to the left of the dividing line on the graph was subtracted from the number of impacts in the column to the right of the dividing line on the graph. The number of impacts in the column to the left of the dividing line was then divided into the difference obtained in the first step. The figure thus obtained represented the percent of increase in resistance to fracture.

A summary of the graphs points out several interesting facts. It is quite apparent that the wide isthmus is a desirable principle. When the Wide Isthmus is combined with either the Plain Pulpal Axial Line Angle or the Rounded Pulpal Axial Line Angle fair gains in resistance to fracture are noticed. However, a great gain (312%) is noticed when the Wide Isthmus is combined with the Rounded Pulpal Floor and the Rounded Pulpal Axial Line Angle.

A general comparison between the Plain Pulpal Axial Line Angle and the Rounded Pulpal Axial Line Angle shows that only very small gains are made. However, good gains are made when either the Plain Pulpal Axial Line Angle or the Rounded Pulpal Axial Line Angle is compared with the Rounded Pulpal Floor and the Rounded Pulpal Axial Line Angle. This gain is especially good when the comparison is observed in the Narrow and Wide preparations.

Side Retention grooves compared to the "U" or Gingival Wall Retention groove shows that the Side Retention grooves increased the percentage of resistance to fracture greatly in the Narrow preparation and even slightly more in the Wide preparation.

CHART I

Series I, Group 1

Tooth Designation	Plain Pulpal Axial Line Angle						
	Test number					Av, GE	Total av.
	1	2	3	4	5		
NP1	18	31	25	17	22	22.6	17.1
NP2	8	19	20	14	8	13.8	
NP3	20	12	14	13	15	14.8	
Average	15.3	20.6	19.7	14.7	15		
NU1	33	24	14	35	22	25.6	23.9
NU2	17	43	10	29	15	22.8	
NU3	30	22	26	17	21	23.2	
Average	26.7	29.7	16.7	27	19.3		
		X		X			87.0
NS1	70	52	93	79	75	73.8	
NS2	71	120	130	100	48	93.8	
		X					
NS3	68	98	132	91	78	93.4	
Average	69.7	90	118.3	90	67		

CHART II

Series I, Group 2

Tooth Designation	Plain Pulpal Axial Line Angle						
	Test number					Av, GE	Total av.
	1	2	3	4	5		
WP1	21	17	25	40	35	27.6	31
WP2	26	29	36	39	40	34	
WP3	22	45	32	28	30	31.4	
Average	23	30.3	31	35.7	35		
			X				30.8
WU1	22	28	39	35	29	30.6	
WU2	25	35	29	25	32	29.2	
WU3	25	29	37	40	32	32.6	
Average	24	30.7	35	33.3	31		
			X				125.3
WS1	139	117	122	126	118	124.4	
WS2	146	116	142	111	126	128.2	
	X				X		
WS3	124	158	92	128	114	123.2	
Average	136.6	130.3	118.7	121.7	119.3		

CHART III

Series II, Group 1

Tooth Designation	Rounded Pulpal Axial Line Angle						
	Test number					Av, GE	Total av.
	1	2	3	4	5		
NP1	27	37	25	13	25	25.4	
	X						
NP2	29	47	25	11	16	25.6	24.7
NP3	34	19	33	15	14	23	
Average	30.0	34.3	27.7	13	18.3		
NU1	50	21	16	21	12	24	
NU2	23	21	23	23	35	25	
			X		X		28.8
NU3	48	58	28	12	41	37.4	
Average	40.3	33.3	22.3	18.7	29.3		
NS1	80	66	91	105	86	85.6	
				X			
NS2	147	88	99	104	69	101.4	91.2
NS3	150	67	82	74	60	86.6	
Average	125.7	73.7	90.7	94.3	71.7		

CHART IV

Series II, Group 2

Tooth Designation	Rounded Pulpal Axial Line Angle						
	Test number					Av, GE	Total av.
	1	2	3	4	5		
WP1	43	45	24	22	62	39.2	
WP2	41	34	36	38	20	33.8	34.6
WP3	44	33	24	23	30	30.8	
Average	42.6	37.3	28	27.6	37.3		
WU1	46	57	25	79	43	50	
				X			
WU2	34	28	23	39	33	31.4	38.9
WU3	28	26	52	47	23	35.2	
Average	36	37	33.3	55	33		
	X						
WS1	166	159	91	90	172	135.6	
WS2	140	155	144	95	101	127	
		X					138.7
WS3	171	150	157	184	96	154.7	
Average	159	154.6	130.6	123	123		

CHART V

Series III, Group 1

Tooth Designation	Rounded Pulpal Floor and Pulpal Axial Line Angle						
	Test number					Av, GE	Total av.
	1	2	3	4	5		
NP1	34	X 60	71	61	46	54.4	
NP2	57	64	52	49	62	56.8	
NP3	X 48	83	53	72	51	61.4	57.5
Average	46.3	69	58.7	60.7	53		
NU1	51	X 59	63	62	72	61.4	
NU2	40	57	X 71	56	58	56.4	57.6
NU3	66	34	47	65	63	55	
Average	52.3	50	60.3	61	64.3		
NS1	X 214	187	221	191	181	198.8	
NS2	187	179	214	206	191	195.4	
NS3	139	147	204	X 189	161	168	187.4
Average	180	171	213	195.3	177.7		

CHART VI

Series III, Group 2

Tooth Designation	Rounded Pulpal Floor and Pulpal Axial Line Angle						
	Test number					Av, GE	Total av.
	1	2	3	4	5		
WP1	81	X 105	128	90	79	96.6	
WP2	62	71	X 79	76	59	69.4	81.5
WP3	X 81	46	81	84	101	78.6	
Average	74.7	74	96	83.3	79.7		
WU1	X 135	198	219	186	139	175.4	
WU2	152	X 153	155	170	169	159.8	158.7
WU3	166	X 132	106	149	152	141	
Average	151	161	160	168.3	153.3		
WS1	778	723	749	618	678	709.12	
WS2	609	718	594	721	856	699.6	771.9
WS3	X 1002	X 869	X 789	968	906	906.8	
Average	796.3	770	710.7	769	813.3		

CHART VII

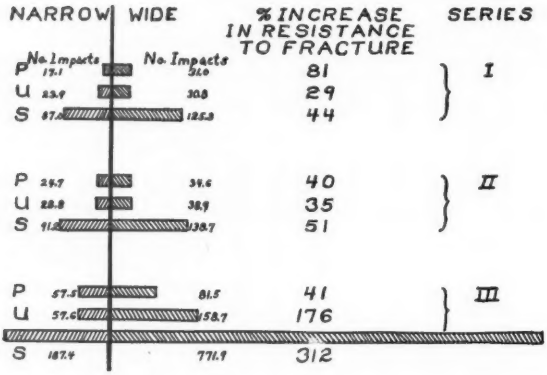


CHART VIII

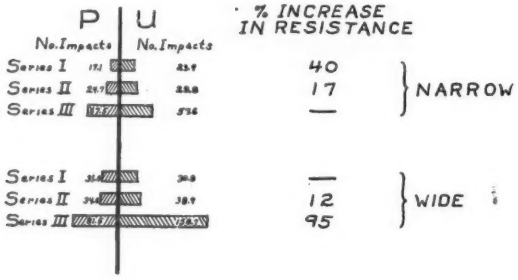


CHART IX

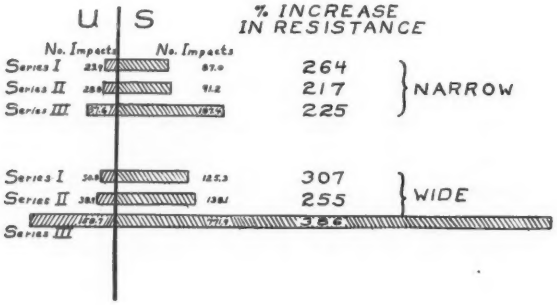


CHART X

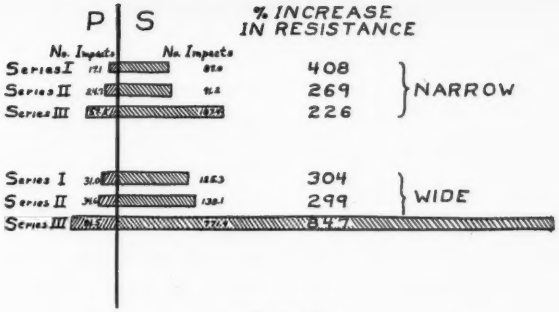


CHART XI

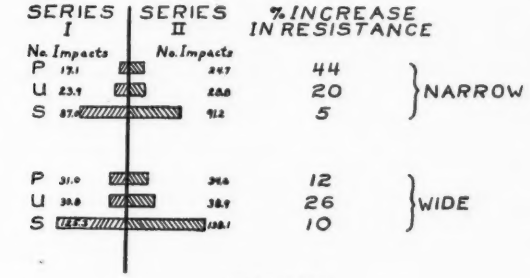


CHART XII

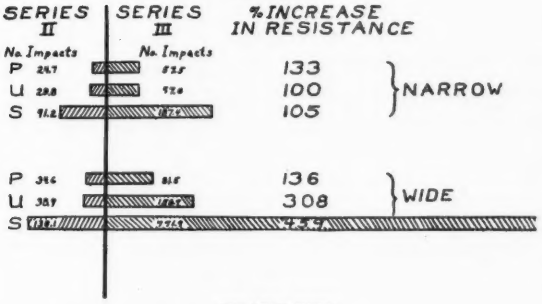
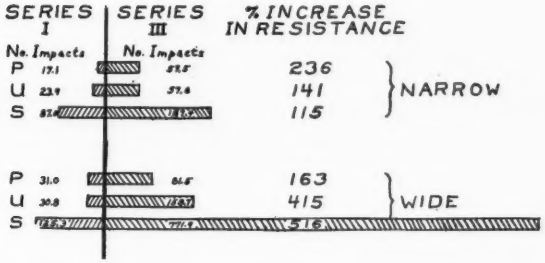


CHART XIII



When the Side Retention grooves were added to the tooth with the Plain principles in both the narrow and wide preparations, great increases in resistance to fracture were noted. This increase was very great (847%) in the preparation containing the Rounded Pulpal Floor and the Rounded Pulpal Axial Line Angle.

It is interesting to note that when the cavity preparation with the constant principles, Narrow isthmus, Flat Pulpal Floor, and Plain Pulpal Axial Line Angle, is compared to the cavity preparation with the constant principles, Wide isthmus, Side Retention grooves, Rounded Pulpal Floor and Rounded Pulpal Axial Line Angle, there is an increase in resistance to fracture of 4414 percent.

So that the results could be evaluated and compared with similar problems in the future the following formula was used to establish the force of impact used in this problem.

The weight of the steel rod used to create the impact force, was 205 grams or .45 lb. The distance it was dropped was 4 cm. or 1.6 inches or .133 ft.

Impact Force = Loss of Momentum
Foot pounds per second = Loss of Momentum
Loss of Momentum = Mass × Velocity
Mass = Weight in Pounds
Velocity = $2gh$ or $V^2 = 2gh$
g = gravity = 32.2 ft./sec.
h = distance dropped in feet.

Therefore:

Impact force = Mass × Velocity
$.45 \times 2gh$
$.45 \times 2 \times 32.2 \times .133$
$.45 \times 8.565$
Impact Force = 3.854 ft. lbs. per second

Conclusions

The results obtained from this study indicate that various combinations of principles employed when a Proximo-occlusal cavity is prepared in a primary molar can significantly alter the restoration's resistance to fracture. In general, whenever a principle which we tested was added, the resistance of the restoration to fracture was increased. Since every principle tested was clinically feasible and practical, it is now possible to describe and advocate a Proximo-occlusal cavity preparation for a primary molar which may be used by all dentists teaching or practicing dentistry for children.

The results of this study indicate that a Proximo-occlusal silver amalgam restoration placed in a primary molar will withstand the stress of mastication better and be less likely to fracture if the following mechanical principles are incorporated in the cavity preparation.

1. Those principles which were considered as constants throughout the study must be included. These constants are:
   a. The preparation should be based entirely upon dentin, and may penetrate at least one millimeter deep in any area of a primary molar tooth without fear of exposure.
   b. The buccal and lingual cavo surface angle at the proximal, should flare sufficiently to carry the margins into free cleansing areas. A 90 degree cavo surface angle is desirable.
   c. The area at the buccal gingival and lingual gingival line angles of the proximal box should be gently rounded.
   d. The depth of the gingival floor should be carried just below the level of the gingiva and below the contact of the approximating tooth.

e. The walls of the proximal box should converge slightly as they approach the occlusal.

2. The isthmus should be approximately one-fourth the buccal lingual dimension of the tooth. This is referred to as a "Wide" isthmus.
3. A very important principle which should be included is a rounded pulpal floor which starts very shallow at approximately two thirds of the distance from the pulpal axial line angle to the most distal part of the preparation, and increases to full depth at the pulpal axial line angle. Full depth of the curve is equal to one-half the diameter of a No. 4 bur.
4. A rounded pulpal axial line angle which is equal to at least one-fourth the circumference of a No. 2 bur should be added.
5. Buccal axial and lingual axial side retention grooves in the proximal box from the gingival wall, occlusally to the dentinol-enamel junction should be included.
6. Although the gingival retention groove which extends along the gingival wall at the gingival-axial line angle may not be as important as the other principles, it may be added. The groove shall be equal in depth to one-half the diameter of a No. 1 bur.

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Unit News

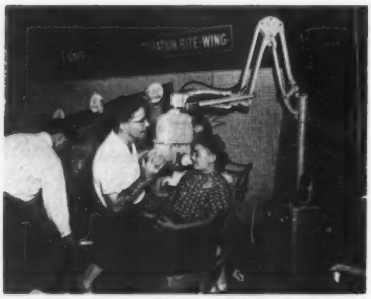
Arkansas

J. R. "Chick" Luten, Jr. sent these pictures to verify the "Operation Bite-Wing" program which was conducted during a state fair.

Picture 1. shows parent registering son and

Picture 2. the radiograph being taken.

Picture 1



Picture 2

New York

On December 5, 1954 the Midyear Meeting was held in the Statler Hotel. Table clinics were given by the following:

1. Herbert L. Haywood, D.D.S., Pl.D.
   Cavity Preparation for Children's Teeth
2. Joseph H. Kauffmann, D.D.S.
   Caries Control and Prevention in Children
3. Seymour Koster, D.D.S.
   Dentistry for the Physically Handicapped
4. Isidore M. Samuels, D.D.S.
   Diagnosis and Treatment Planning for Children
5. Ovid Slavin, D.D.S.
   Management of Extensively Decayed Children's Teeth Requiring Full Coverage

The scientific session found President Solomon N. Rosenstein presiding. The subject was "Oral Diseases in Children" and Edward V. Zegarelli, M.S., D.D.S. was the essayist. All members of the dental and medical profession were welcomed to participate in the discussion.

Michigan

The December program was a success featuring Dr. Manuel Album from Philadelphia who spoke on "Dental Procedures for the Child with a Handicap." "Manny" did his usual fine job.

The February meeting has been cancelled so the Unit can put its full support behind Walter C. McBride and his effort to make Children's Dental Health Week one of the greatest that this state has had.

District of Columbia

At the Executive Council meeting of the American Society of Dentistry for Children held in Cleveland on September 25, 1953, Dr. J. M. Wisan, Chairman of the Public Relations and Publicity Committee, was authorized to give to the District of Columbia, New Jersey and Philadelphia Units several thousand copies of "Pointers for Parents", the leaflet developed under his direction as an educational device for use among those interested in the health of the pre-school child.

This report will outline methods of utilization of the pamphlets by the District of Columbia Unit in the hope that other groups may be guided along similar or even more effective lines.

An organizational meeting with lay persons was held. The need for an educational program and pilot study was demonstrated by discussing the prevalence of dental disease and stressing the importance of preventive measures. To emphasize existing conditions locally, a dental survey and determination of the DMF rate of five hundred nursery school children was planned.

For the survey twenty-two members of the District of Columbia Unit visited twenty nursery or pre-school groups and a DMF rate was established.

Newspapers took cognizance of the survey and gave it good coverage, which of course was of immeasurable educational value.

The District of Columbia Unit, at a regular meeting to which lay persons were invited, discussed "Practice Management of the Pre-School Child". A pedodontist, a pediatrician, a child psychiatrist and a parent were the panelists. Dr. Wisan served as moderator. Pertinent questions were answered by each discussor and again "Pointers for Parents" was brought into focus.

Due to the success of this meeting a similar program was held on National Children's Dental Health Day at a meeting of the District of Columbia Dental Society. "Preparing the Pre-School Child for Dental Health" was discussed by a pedodontist, a pediatrician, a health educator, a child psychologist and a parent. The pamphlets were distributed to those present.

The pamphlets also were distributed with the "Journal of the District of Columbia Dental Society". An article describing methods for its use by the general practitioner and articles on the pre-school child were included in this issue.

"The Georgetown University Forum of the Air", over a national broadcast and a local telecast, featured a panel discussion on dentistry for children. "Pointers for Parents" was offered, on request, to listeners and viewers. The television program was kinescoped and is available for use throughout the country.

The leaflet was also brought to the attention of the "National Parent-Teacher" with the thought that notice of its availability might be given more widespread publicity.

With the pamphlet as a nucleus the District of Columbia Unit was able to expand its scientific and educational programs in many directions. While there is no precise way of evaluating the

results obtained with respect to educating the community for dental health, the following quote from an article in "The Washington Star" of March 10, 1954 may be indicative of the effectiveness of the efforts put forth: "The word 'health' seems to mean to children: toothbrushes, toothpaste, plenty of exercise, correct posture and an awareness of staying away from trouble. At least these things are turning up in posters now arriving at the District Medical Society . . . sponsoring a health poster contest for children of District schools. The posters are illustrating some phase of preventive medicine. Early entries show toothbrushes to be foremost in a child's mind when he thinks of preventing sickness."

Ohio

A joint meeting of the Ohio Society of Dentistry for Children and the Ohio Pediatric Society was held on September 15, 1954 at the Scioto Country Club. After a friendly cocktail session and fine dinner, Dr. Warren Sisson gave an inspiring talk on "Pediatric Dentistry." Dr. Mitchell S. Goodman reports that the enthusiasm of the members reflected the success of the meeting.

Northern California

On December 14, the Northern California Unit of A.S.D.C. met at the St. Francis hotel in San Francisco. Dr. John Tocchini transferred his gavel to the incoming President, Carl Ellertson. President-elect will be Eddie Mack and Vice-President, Haywood Norton. Secretary-treasurer will be Lloyd Richards. Our speaker for the evening was Earle Lampshire who is currently stationed at Moffet Field, California. Earle recently was released from the hospital where he was on the critical list with necrotic pharyngitis but has made a fine recovery. Earle's topic was "More, Better and Easier Dentistry for Children."

Plans were also made at this meeting for welcoming members of the A.S.D.C. to the National Meeting in 1955.

For Children's Dental Health Day in February, Drs. Irwin Beechen, Walt Mandler and Eddie Mack will present panel discussions and table clinics in a one day session of post-graduate instruction in dentistry for children, for the dentists of the Northern California Dental Society.

Dean John Tocchini worked with a liaison committee to the International Longshoremen's and Warehouse men's Union for the development of a dental program for the children of the union members. The program took effect in October 1954. Details of the program appear elsewhere in this issue of the Journal.

Virginia

The Virginia Unit of A.S.D.C. held a three day Post Graduate Pedodontic Seminar at the Medical College of Virginia Dental School the 14th, 15th and 16th of October 1954.

The officers and Dr. Charles Vincent, the Professor of Pedodontics at M.C.V. met at the home of Dr. Harry Lyons, Dean of the Dental School, and planned the Seminar. Dean Lyons extended us a welcome to the full facilities of the Dental School and assisted us in every way to hold our Seminar there.

We had fifty-two dentists attending. It was a very outstanding and instructive meeting.

The Kellogg Foundation, through the Medical College, assisted in financing the course.

Dr. Alfred E. Seyler, Editor of the Journal of Dentistry for Children, covered the subjects of "Child and Parent

Management", "The General Practitioner's Responsibility and Advantage in the Recognition of the Need for Orthodontic Treatment", "Pulp Management, Operative Procedures and Practice Management".

Dr. LeRoy Ellis, Dean of the University of Toronto Dental School, presented "A Broad Concept of Preventive Dentistry", "General Considerations Regarding Injuries to the Teeth of Children", "Common Problems Involved in Treatment of Traumatized Teeth".

Dr. Arnold of the U.S.P.H. lectured on "The Fluoridation Story".

All three clinicians gave full and interesting coverage of their subjects in so far as time would permit, and we are all looking forward to more meetings of this caliber.

The course included a dinner sponsored by M.C.V. and A.S.D.C.

The end came Saturday, October 16th with a round table discussion with Dr. Vincent of the Pedodontia Department of M.C.V. as Moderator and Dr. Seyler and Dr. Ellis as panelists.

We, of the Virginia Society of Dentistry for Children, want to take this opportunity to thank Doctors Seyler, Ellis and Arnold for their very instructive and informative lectures which made our Seminar such a success.

The officers of our Unit are:

Dr. L. Henter Blevins, President—Arlington, Va.

Dr. T. C. Bradshaw, President-Elect—Blackstone, Va.

Dr. John J. O'Keefe, Jr., Vice President—Ocean View, Va.

Dr. Charles J. Vincent, Secretary-Treasurer—Richmond, Va.

Dr. Ralph C. Sheals, Editor—Arlington, Va.

RALPH SHEALS, *Editor*

SOUTHERN CALIFORNIA UNIT

4TH ANNUAL POST GRADUATE CONFERENCE, FURNACE CREEK INN—DEATH VALLEY, CALIFORNIA

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All this AND:

CLINICS ON SUBJECTS ESPECIALLY APPLICABLE IN THE PRACTICE OF DENTISTRY FOR CHILDREN

The opening meeting of the Conference will be Wednesday evening, March 30, and will conclude with luncheon Saturday noon, April 2.

Furnace Creek Inn at Death Valley promises to be an ideal place for the meeting. Weather conditions at this season are expected to be ideal.

The Conference fee is $85.00 including lodging and meals. This fee may be paid in two installments if desired—$25.00 must be paid with application and the balance of $60.00 by March 15th. Make checks payable to the S.C.S.D.C. and mail, together with application enclosed, to:

Miss Lorraine Duncan
3780 Wilshire Boulevard
Los Angeles 5, California

Is Dental Treatment for the Handicapped Child a Special Problem?

MILTON E. GELLIN, D.D.S.

WITH the shortage of dentists there has been a growing demand for more work per practitioner. The advent of high speed cutting instruments, increased use of sedatives, and the more frequent use of general anesthetics for operative dentistry represent dentistry's efforts to meet the demand. Especially in the field of dentistry for children, completion of all operative procedures at a single sitting is emphasized. (1, 2, 3, 4, 5, 6, 7, 8) This service may be efficient from the point of view of saving time but has definite drawbacks. The average general practitioner's office is not equipped for emergencies which may arise from the use of general anesthesia. General anesthesia is a tool which has been used to avoid the psychological management of children. By the use of general anesthesia there is complete elimination of the experience factor. General anesthesia is advocated so that the initial visit will result in the completion of the necessary services. It is generally stated that subsequent visits do not involve the administration of another anesthetic. This happy situation cannot be predicted accurately for every child. There are definite physical and psychic traumata leading to personality changes when general anesthetics are employed. (9, 10, 11) Many of the child management problems in a pedodontic practice may be attributed to the previous use of a general anesthetic, or to conditions associated with its use. This is a striking fact too frequently overlooked. The future dental care of children subjected to this treatment may lead to the necessity of using general anesthetics for all subsequent treatments. This shortsighted policy may carry over into adult life: there are many adults who insist that their dental care must be done while they are asleep. This is a violation of sound pedodontic principles. A basic pedodontic premise is the education of the child to accept dental treatment in a cheerful healthy attitude. Education should be given priority over immediate treatment. Advocates of the use of general anesthesia often mislead parents to the effect that this is the best mode of treatment.

The handicapping disorders of children that are of interest to dentists are mental retardation, cerebral palsy, muscular dystrophy, deafness, blindness, congenital heart defects, Mongolism and rheumatic fever. There are other and more rare disorders which need not concern us. The fundamental knowledge of these disorders is essential in performing dental services. The parents of these children are anxious to seek help from one who has an understanding of the child's handicap. (12, 13, 14, 15, 16, 17, 18) All of the health agencies have been called upon to help in the rehabilitation of these children. Pediatricians, psychologists, orthopedic surgeons, speech, occupational and physiotherapists, teachers and social workers are the professional people who help to provide treatment for these handicapped children. The task of all therapists is to help the child expand

his potentialities, to increase his understanding, and instil self-help activity. We as dental therapists must accept this philosophy and perform our services in such a way as to provide experience, education and character building to these handicapped children.

Why should there be a dental problem peculiar to the handicapped child? The demand for service to handicapped children originated with the parents of these children. These parents asked five basic questions of the dental profession. Why did the gingival tissues swell? What harm would come from the wearing away of the teeth? Why were there so many decayed teeth? Why were children refused dental treatment merely because of a physical condition? Would the abnormal facial pull cause teeth to move out of position? Without the activity of these parents dentistry would probably still be unaware of the deplorable dental health of these children.

Why has dentistry lagged in this field? The answer can be divided into four basic facts. (1) Large amounts of time must be devoted to these children often without proper remuneration. (2) We have difficulty in finding dentists who will devote their time to the non-handicapped child, therefore the handicapped is beneath their consideration. Many men do not understand the management problem in normal children. (3) Failure to understand the handicapping conditions will in many instances result in refusal of treatment. (4) There is the feeling on the part of some that specialized training is necessary.

It is possible to disregard the diagnosis of physical handicap as far as dental service is concerned and accept the child as an individual who can learn. The same procedures employed for the non-handicapped child may be used for the handicapped child. Therefore, our task is to group all children into two general categories, that is, those children who range from normal to moderate mental retardation and those who are severely retarded. The evaluation of the child is accomplished only by repeated visits. During this trial period it is possible to determine whether the child can be treated as normal or whether some sedation may be required. Discussion with the parents about the activity of the child in the home will yield an insight into the learning capacity of the child.

Let us discuss the problems encountered in treating a child who can learn no matter how severe his handicap may be.

The dental picture of the handicapped child is no different from that in the normal child with the possible exceptions of prevalence to a greater degree of poor oral hygiene and the existence of muscle spasm. The gingival pathology is chronic in many instances. The parents are reluctant to brush the child's teeth and gingivae because of possible injury, the brush may be too large, or the child may not permit the parent to clean his mouth. The chronic involvement will eventually result in the child becoming a dental cripple. Many physical handicaps involve the facial and masticatory muscles, so that in many instances it is impossible to place artificial appliances. This far-reaching problem must be intercepted in early childhood. The need for a dental home care kit is becoming more and more imperative. This problem may be partially solved by giving the parents the Denticator type B with attached interproximal stimulator and the individual tuft, with definite instructions for its use. The results are better with this than they were in previous experiences with various types of toothbrushes. There is need for further investigation in this

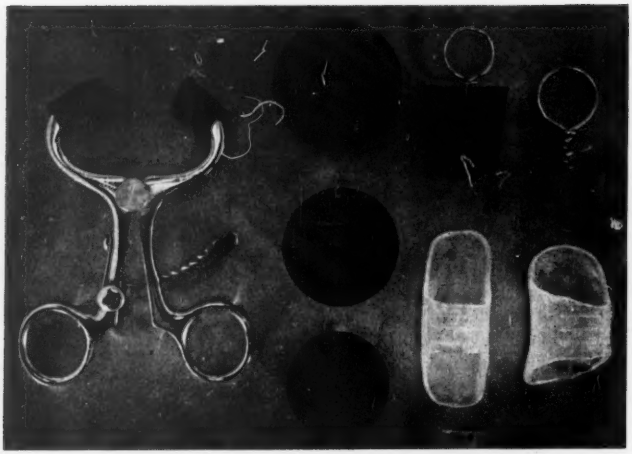

FIG. 1. Molt gag, rubber stoppers, acrylic splints

aspect of the periodontal problems of the handicapped.

As previously mentioned, the muscles of the face and of mastication are extensively involved so that voluntary mouth opening may be greatly inhibited.

Several types of appliances may be used for mouth stabilization to provide adequate security measures. There are three types of mouth props that can be employed: rubber stoppers, Molt gag, and acrylic splints. (figure 1) A corkscrew from the cement base units is inserted into a rubber stopper number 5, 6, 7, or 8. When working on the upper left side the ring with attached rubber stopper is placed over the fourth finger of the right hand with the handpiece held with the thumb, index and middle fingers. The stopper is placed on the right side. This technique can easily be mastered after a little practice. When working on the upper right side the ring with attached rubber stopper is placed over the fourth finger of the left hand with the thumb, index and middle fingers holding the mirror. The stopper is then placed on the left side.

The acrylic splints are made very simply by molding pink wax to the middle finger and the thumb of the left hand. The wax extends over the dorsum of the fingers in question to cover all phalanges of the middle finger and the two phalanges of the thumb. On the palmar portion of the finger and thumb the wax is confined to the middle phalanx and the proximal phalanx of the thumb. In this manner the finger can be flexed. The wax is then processed in clear acrylic to be less conspicuous. After processing, grooves are placed on the palmar portion to prevent sliding over the incisal edges of the lower anterior teeth. When working on the lower left side the splint is placed on the middle finger and inserted into the mouth from the front position while the index finger retracts the cheek and the thumb supports the chin. When working on the lower right side the splint is placed on the thumb and inserted into the mouth from behind the patient with the

crotch of the elbow supporting the head. The index finger retracts the cheek with the chin supported by the third, fourth and fifth phalanges. In many cases the Molt gag will be necessary to open the mouth in order that the splints or rubber stoppers can be inserted. The Molt gag may be used alone in instances where long procedures are employed.

With these various mouth props, cut or continuous child size cotton rolls can be manipulated to a greater extent. The Garmer child size cotton roll holder will serve as a valuable aid in keeping the field dry when the Molt gag is employed. The inherent fear of insecurity must be overcome so that the child will be able to concentrate on what is said to him. There are various means employed to promote this feeling of security. The first is a simple one, tilting the chair quite far back. The child can be literally anchored so that forward motion is prevented. If the child is wearing braces ordinary roller skate straps can be laced through the braces to the chair arm. The device in figure 2 was developed and used in the dental clinic of the Johanna Grasselli Home for Crippled Children, known as the Rose-Mary Home. The framework is bolted to the chair in such a manner that it can be easily removed. Pressed wood is used as a platform which is bolted separately to the framework. The portion that engages the sole of the foot is movable in metal slots with wing nuts. If braces are worn there is no need for straps as in figure 4. The arm splint is necessary in many conditions to decrease the need for the assistant to constantly hold the child's arms. The child is not submitted to any injury by restraining an athetoid or spastic arm. The arms of the child are folded and placed in the pockets shown in figure 3. It has been found necessary to engage the elbow joint from the anterior as well as the posterior aspects, hence the tie in back of the chair as well as in the front of the child. (figure 4.) In this manner the rotary movement of the arm is prevented. It has been observed that the excessive motion of the handicapped child, es-

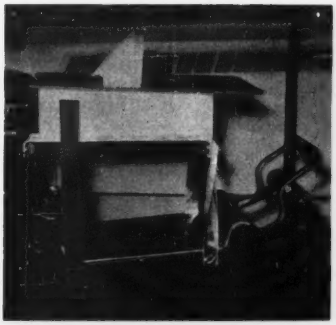

FIG. 2. Stabilization platform

FIG. 3. Arm splint with pocket

FIG. 4. Arm splint fastened to prevent all movements and stabilization platform with attached straps. Note sandbag since child was too small.

pecially the cerebral palsied, was somewhat controlled for 15–30 minutes after the child had received whirlpool bath therapy. The relaxation after this hydrotherapy was markedly noticeable to the extent that arm splints were not necessary. It must be emphasized that aids in stabilization are not used as a strait jacket to hold a struggling child in position. They are used with the consent of the child—most children welcome these aids. It is impossible to work on a struggling child. The child must be taught to accept dental care and this is one of the principal objectives of this mode of operation.

By impressing upon the parents the importance of dental education of their child, the necessary and frequent visits will be acceptable to them in spite of distance and other hardships involved. The child learns to cooperate in the dental office. Sometimes this type of management aids in the adjustment of the child to other types of treatment situations. The parents will return with information about gratifying experiences of the child in the barber's chair, school activity, and cooperation with the various therapists. With this type of management dentistry can certainly take its place in the rehabilitation of handicapped children.

A further discussion on other phases of treatment might be of value at this time. These phases are largely irrelevant of any specific physical problem since they are also present in the non-handicapped child. Comparatively, there are no differences in techniques employed with handicapped children and normal children. Local anesthetics are administered for all procedures whether of long or short duration. The one deviation is the elimination of the matrix retainer in filling permanent teeth. It is not used since damage could be inflicted if the mouth closes accidentally. A T-band is festooned out of occlusion with dental tape inserted completely around the band and tied on the buccal. This will provide a very adequate matrix under these conditions.

A dental assistant is most important in providing this type of educational treatment. Without her help procedures are too long. The various mouth props may be employed to a better advantage if the assistant holds them. By the use of the methods in stabilization outlined above the assistant is relieved so that she may obtain materials and instruments.

The field of correction of malocclusion in the handicapped child should be explored. It is possible that only a relatively small proportion could be helped by this service, but every effort should be made to investigate this field.

The development of a suitable x-ray technique is imperative. With the aid of a Molt gag, an x-ray film held in a hemostat is satisfactory. In some cases a hemostat placed through a rubber stopper may also be of value.

The preceding statements pertain to the child who can learn to accept dental procedures after a period of time. A certain percentage of cases with severe mental retardation will present themselves. For

these individuals a suitable general anesthetic under proper conditions is essential. Let us discuss the possible methods of treatment if such a case presents itself. The first procedure is to try treatment of the patient as in the manner presented. No medication is offered until it has been determined that there is no potential for learning. If this has been determined a sedative should be tried. As a last resort a general anesthetic is employed. Even with the normal child there may be brain damage due to oxygen deprivation but the reserve tissues compensate for this injury. There is every reason to assume that there may be greater permanent changes in severely involved brain-injured children since the reserve tissues are not available. There is much to be said for the principle that elaborate mouth rehabilitation in severe mental retardation is not advisable. In these cases the removal of all teeth with any degree of dental pathology is advocated. The diet of these individuals is very poor since mastication is minimal. Repeated visits for follow-up examinations are impossible since the inconvenience of transportation and the manipulative procedures required for each anesthetization are too complicated for parents to tolerate. The cost of such treatment in many instances is prohibitive. The permanence of the dental restorations is often doubtful since the oral hygiene problems will nullify even the best treatment. In these severe cases the teeth are an insignificant part of the picture and not essential for the maintenance of life.

Summary

The need for accepting the handicapped child on the basis of educatability rather than on the basis of his handicap has been presented. Stabilization devices and suitable mouth props can be used to great advantage. The effort will be rewarded in that more children can receive treatment in the general practitioner's office. The use of general anesthetics and auxiliary drugs should be minimized since education of the handicapped child is one of our main goals.

Conclusions

1. The dental problems of the handicapped are relatively small and have been magnified out of proportion.
2. Only repeated visits can determine whether or not a child is in need of a general anesthetic.
3. An efficient method of mouth care which can be taught to the parents for use in the home should be developed.
4. X-ray techniques should be modified in the effort to obtain satisfactory roentgenograms.
5. Investigation of further aids in stabilization seems to be a fruitful field in the care of handicapped children.
6. Investigation into the possible use of hydrotherapy as an aid in dental treatment may be of value.

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THE AMERICAN SOCIETY OF DENTISTRY FOR CHILDREN

APPLICATION FOR MEMBERSHIP

I am interested in becoming a member of the American Society of Dentistry for Children.

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ADDRESS.....

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If you are a dentist or physician, you must be a member in good standing of your local dental or medical Society.

If you wish associate membership, please indicate affiliate society membership.

Send this application to:

American Society of Dentistry for Children
Mt. Royal and Guilford Avenues
Baltimore 2, Maryland

Bulletin

The following information from the California State Dental Association seems important enough to bring to the attention of all A.S.D.C. members.

To: Members of the California State Dental Association
FROM: Committee on Dental Care
RE: ILWU-PMA Welfare Fund pilot dental care program for children

Early in 1954, newspaper accounts announced a plan of the International Longshoremen's and Warehousemen's Union to secure a dental care program for children of union members. It was planned that this would be financed out of the Welfare Fund of the Union and the Pacific Maritime Association. Negotiations between the ILWU and the PMA resulted in agreement to establish a one-year pilot dental care program for children under age fifteen and to expend an amount not to exceed $750,000.00. The agreement was effective June 14, 1954.

It is important for the profession to realize that this program was initiated by labor and management. The Welfare Fund's trustees were obligated under this agreed contract to provide dental care by any method which might be available.

In March, representatives of the American Dental Association and officers and members of the Joint Legislative Committee of the California and Southern California State Dental Associations met with the secretary of the Pacific Maritime Association. A full report was presented to the House of Delegates at its April 25 and 28 sessions. The House of Delegates instructed the Committee on Dental Care to confer with any groups that may be considering prepayment or dental service programs, and to seek every available bit of information on what demands have been and are being made. Acting on these instructions, the Committee met with representatives and trustees of the ILWU-PMA Welfare Fund, starting in early June.

The Committee learned the ILWU-PMA Welfare Fund planned two programs, with persons eligible for Welfare coverage having individual selection of the type of dental care facility they preferred for their children. One would be a closed panel with a group of dentists working under a direct contract with trustees of the Welfare Fund. The second program would be one of indemnification with an open panel. Signup for care under the two plans was started in the San Francisco Bay area on September 20. Actual care will start October 1, 1954. The pilot program will be installed in the four major Pacific Coast ports of San Francisco, Los Angeles, Portland and Seattle. The operation will commence in the Los Angeles, Seattle, and Portland areas soon. Counties included in the San Francisco Bay area pilot program are Alameda, Contra Costa, Marin, San Francisco, San Mateo, and Santa Clara.

Contracts will be entered into by trustees of the Welfare Fund with dentists to operate two clinics in this area on a closed panel basis. One is to be established in San Francisco, the other in Oakland. Children of members of the union who choose the closed panel operation will be cared for in the two clinics during the pilot program. Once a choice of plan has been made, there can be no change during the test period.

In order to meet requirements of California law, two methods would seem available: (a), a nonprofit corporation and, (b) an insurance company indemnity program.

To establish a nonprofit corporation as a legal vehicle to operate the open panel plan by the profession, for all practical purposes, it should be statewide, which calls for agreement between this Association and the Southern California State Dental Association. The problem of meeting legal requirements and developing complete agreement between the two Associations would not permit establishing such a body by the October 1 starting date, but work is proceeding.

Trustees of the Welfare Plan, to provide opportunity for free choice of dentist, adopted a proposal of the Continental Casualty Company to provide a means of an indemnification, open panel operation on a trial basis. The Company admittedly does not know what can be developed in the future, but for the pilot period is assuming all costs of claim payment and taxes in order to gather statistics upon which it can base a program. It will be reimbursed by the Fund for the exact amount it pays members of the profession for care rendered, plus two per cent.

Under the indemnification program, children will be allowed up to a maximum of $75.00 for care until September 30, 1955, based upon the median fee established by surveys of the profession. In addition, up to $150.00 per year insurance is provided for accidental injury to teeth in accordance with the fee schedule. Dentists will be permitted to render care beyond the $75.00 limit providing there is a positive agreement for such care between dentists and parents prior to its being rendered. In such an instance, parents must pay for the additional care. Dentists may also charge a fee greater than that of the indemnification schedule subject to complete agreement with parents who will then assume the additional charge.

Certain types of care are specifically excluded. These are orthodontics; cosmetic dentistry; and services covered under the ILWU-PMA medical plan which includes all major dental surgery, such as fractures, but not dental extractions which will be paid for under the indemnification plan.

Under the indemnification plan, children may go to any member of the profession who is a member of the Association or who is eligible for membership. The Welfare Fund will require parents of children age two and older to make dental appointments for them as soon as they can after the program gets under way on October 1. The Fund will especially urge early appointments for children now over age 14 in order that as much work as possible can be done before their coverage ends on their fifteenth birthday.

Dentists will be asked to complete an examination and treatment planning form for each child. This will be in duplicate and supplied by the Fund. Dentists will retain the original copy for their files and submit the carbon copy to the Welfare Fund, in accordance with an authorization for release of a child's dental records which the parent signed at the time of enrollment.

Upon the first visit of a child, the dentist may make his clinical examination, take x-rays, perform a prophylaxis, make his treatment planning, and render whatever restorative care he can up to an amount not to exceed $75.00, unless a prior agreement is had with parents to exceed that amount, as previously explained. Care that cannot be rendered on the first visit may be performed at subsequent appointments. All care under this program must be completed prior to a child's fifteenth birthday and before October 1, 1955. Dentists shall render their statements for completed care to the Welfare Fund on a monthly basis. Payment will be within sixty days through Continental Casualty Company.

In adopting its program, the Welfare Fund stressed its two-fold purpose: Preventive dentistry, and as much high quality restorative care as is possible. It plans an extensive dental health education program. The Association's Dental Health Education Committee is working with the Fund in developing this feature. Trustees of the Fund also plan appointment of a dental advisory board which will review treatment planning and performance, and which will consider disputes as to quality of care.

Success of the indemnification program rests with members of the profession. It is imperative that high quality care be rendered and that there be a most cordial dentist-patient relationship if we are to retain the plan whereby patients may select a dentist of their choice. The Committee on Dental Care will endeavor to supply any further information that may be desired and will attempt to answer specific questions.

Committee on Dental Care

WILLIAM B. RYDER, JR., Chairman
RICHARD T. NAISMITH
ROBERT O. SCHRAFT
JOHN TOCCHINI
FREDERICK T. WEST
JOHN G. ROOKS, ex officio, secretary

Annual Meeting

Miami

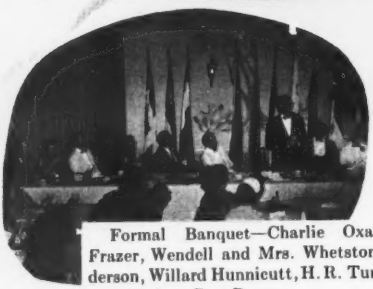
Formal banquet—retiring President Hugh Keenan turning over the gavel to incoming President Willard Hunnicutt. Seated: H. R. Turner, Wayman Parker, speakers, and Dan Rentz of Miami.

President's Luncheon

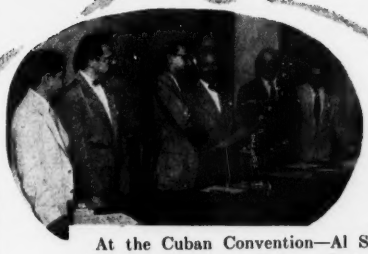
Visiting dentists from the Pan-Americas

Table Clinics

Dave Law admiring one or two of the exhibits!



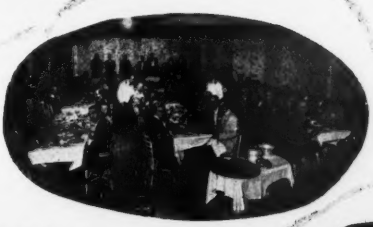
Formal Banquet—Charlie Oxar, Trudy Frazer, Wendell and Mrs. Whetstone, Al Anderson, Willard Hunnicutt, H. R. Turner, Wayman Parker, Dan Rentz.



At the Cuban Convention—Al Seyler receiving clinician's scroll from Carlos Criner. Looking on—one of the Cuban dentists, Bill Brown, George Teuscher in the background, Hal Addelston, Antonio Montero of Havana.

Formal banquet—Al Anderson, Willard Hunnicutt, H. R. Turner, Wayman Parker, Dan Rentz, Hugh Keenan, Mrs. Keenan, Henry Wilbur, Mrs. Wilbur.

At the Cuban Convention in Havana. Attentive listeners to Hal Addelston.



President's Luncheon

One of the lighter moments! Wendell Whetstone, Jack Langley, Trudy Frazer, Al Anderson, Charlie Oxar.

Table Clinics

Theoretical Aspects of Fear

GRANVILLE FISCHER, PH.D.*

I AM not a dentist. I am not conversant with the professional problems of dentists for children. I am a psychologist. I speak to you at this time only as a psychologist, not as an expert in the field of dentistry for children. Whatever humble contribution I may make you may utilize as you will, as we all pool our resources in that one large enterprise which cuts across professional and academic boundaries; namely, the amelioration of human ills and suffering, to the betterment of man's lot on this earth.

My assignment deals with the theoretical aspects of fear, and I shall confine my remarks as closely to that as possible. Fear is the experience of a certain type of emotional state of an organism in the process of trying to adjust to a situation.

The human being, together with all animals, is trying to get along in his world fundamentally on the basis of the pleasure principle; that is, he seeks those situations and experiences which promise pleasure and satisfaction; and he avoids those which have been experienced as painful, or which are perceived as threatening pain. Overlooking some minor criticisms to this hypothesis, we can use the pleasure principle as a springboard for our discussion.

We are goal-seeking animals. Energy is mobilized to aid us in our efforts to reach our goals and satisfactions. Many obstacles stand in our way to an unimpeded actualization of our purposes. These obstacles constitute problems which we must learn to solve if we are to set ourselves again on the pathway toward our goals. When the solution is not readily forthcoming, the adrenal glands begin to react to the emergency by secreting their substance, adrenalin, adrenin, or epinephrin, into the blood stream. This substance acts as a catalytic agent on various organs and systems of the body; mobilizing energy for the purpose of finding a way around the obstacle, removing the obstacle, or removing the organism from the situation.

According to the way in which the obstacle is perceived by the organism, or the person, it may be approached aggressively in an effort to find a solution. Continued frustration of such efforts may agitate the emotional state until an attack of rage results. Now, if the person or the animal perceives the obstacle as beyond his resources for solution; or as actively threatening to himself, and overpoweringly so, the emotional reaction will mobilize the individual for flight, and this reaction will be experienced as fear.

Aggression and rage, then characterize an emotional state where energy is mobilized for attack; fear where energy is mobilized for flight because of a perception of inadequacy on the part of the individual for coping with the situation where his safety and well-being are threatened; or, to put it in other words, where there is the threat of pain. Of course, the pain can be either physical or psychological. The emotion giving rise to the experience of fear, then, has biologic utility in removing the individual

* Presented as part of a panel discussion "The Child, The Dentist and Fear."

from that which threatens to pain him, or destroy him.

Note that we indicated the *emotional* nature of the reaction. This is in contrast to an intellectual appraisal of a situation and an attempt to solve it on an intelligent basis. Fear is a primitive reaction; an old-brain rather than a new brain reaction; a hypothalamic and autonomic reaction rather than a cortical or frontal lobe reaction. The fear reaction will manifest itself often in the face of contrary testimony of the intellect; sometimes to the embarrassment and confusion of the individual who is at a loss to find a rational basis for his fear reaction. That is why one is usually unsuccessful in an attempt to *reason* a person out of his fears. Logic, reason, and judgment are functions of the frontal lobes. The seat of fear is the autonomic nervous system with its thalamic connections. This is not to suggest that reason and emotion operate to the exclusion of each other. They do not. Nor is it to say that cortical control over the emotions and other autonomic functions, is impossible. Controlled experimentation has demonstrated otherwise.

With this brief background we are in a better position to comprehend the fear reaction in a variety of situations. About the earliest fear reaction is observed in the very young infant in situations where he experiences a sudden loss of support or displacement. Suddenness, or abruptness of stimuli impinging upon the sensorium does not allow adequate organization on the part of the individual for coping with the situation. Intensity of stimulation, for example, a loud noise, will likewise elicit the fear response. I think we could sum this up by saying that the *unexpected* does not allow for preparation and organization, and thus catches the individual unprepared with appropriate and effective responses. As a result he is overwhelmed with a feeling of helplessness and fear.

Almost as primitive as the above is the *unfamiliar*. That which has not yet been met and dealt with; the novel, the strange, whether this be in terms of persons, places, things, or situations, finds the individual again unprepared and apprehensive. As the unfamiliar becomes familiar, fear usually is mitigated; that is to say, when the internal process of the person become reorganized to assimilate or accommodate the novel situation; when he has learned how to respond efficiently in that situation; when he has explored it and found no threat of pain to outweigh his safety and well-being, the fear will likely dissipate.

Fear of the dark can be understood now as due to a feeling of helplessness; a deprivation of the usual visual cues that allow us to deal more effectively with our environment.

The fear of isolation, or being alone, rejected or abandoned, is in the same vein. In infancy and childhood we did not actually have a repertoire of responses adequate for solving many of life's problems. But the proximity of the parent, especially the mother, who in the perception of the very young, was omnipotent and omniscient; who could solve any problem and could protect from any danger, was a very stabilizing factor. In these early days, to be separated from the parent was to be in jeopardy. This becomes generalized into a fear of rejection by the parents, or by the group. We read a great deal about conflict between goals. There is also a conflict between fears. The fear of group rejection, and hence isolation, may be strong enough to overcome other fears; even the fear of death.

Fear is generated not always by actual dangers. Sometimes the fear is of that which is made up of the stuff of imagination; for example, ghosts, and goblins, or other imaginary creatures, or imaginary situations. Then there are the phobias, which are irrational fears; corresponding to no real external danger, but deriving usually from unconsciously conditioned associations.

Emotions, also, are contagious; and fear is no exception. A child reared in an atmosphere of fear and anxiety will probably display these reactions out of proportions. Also, the same would be true for hatred, aggressiveness; or on the other hand, love, stability. Pupils of emotionally disturbed teachers show more disturbance than pupils of stable teachers. A child in a family where dentistry is taken as a matter of course, where it is discussed dispassionately and favorably, will not show the concern and fear seen in a child from a home where the gruesome and gory details of dentistry are emphasized, and where the fear reaction to the painfulness is reiterated again and again.

Memories of Miami Beach—November 1954

Standing: Hal Addelston, Mrs. Teuscher, Mrs. Addelston, the Fish, George Teuscher, who caught the Fish with the help of the crew, seated.

"The Child, The Dentist and Fear"*

Richard S. Youngs, D.D.S.† and Francis M. Schmitt, D.D.S.‡

MANY parents and occasionally their dentists expect too much from the children. In spite of the physical growth that is so evident in the child, mentally or psychologically they grow very slowly. Parents and their dentists must have the required patience to prepare the child so that he may be satisfactorily treated in a manner that is agreeable to both the child and his dentist.

It is impossible to generalize when referring to children, as they vary greatly depending on their past experiences. Fear in the child must be considered not only in the dental problems but fear in general. All fears do not stem from reality, but many from imagination. Imagination is very important to the human race. Without it bridges would never have been constructed, plans would never have been engineered for cities, automobiles, farm equipment, etc. But imagination has also created problems and anxieties of possible occurrences, dangers and injuries. These anxieties may lead to serious psychological problems not only in the child but also in the adult.

It is important that children be conditioned to fear such things as traffic, snakes and loaded guns.

Now consider conditioning the child to the dentist. Proper preparation will not create the problems that may arise from improper preparation such as the parents' references to any unpleasant experiences they may have had with dental treatment. Use positive, constructive conditioning. The parent in many instances should consider conditioning himself before expecting to condition the child for his visit with the dentist.

Children must be made to feel welcome in the dental office. If dentists expect children in their offices they should let the child know this as insincerity is quickly recognized by the child and will soon initiate his feelings. It has been said, "*More dentists are afraid of children than children afraid of dentists.*"

In the dental office as in the home, the tone and references in the voice are more important than the written word. "Voice Control" should be considered an important factor to influence the child. We can all recall the voice inflections of Lowell Thomas, Winston Churchill and Franklin Roosevelt.

Want must also be considered along with fear. Both should be rationalized and trained as both factors influence emotions. Strong emotions are not always harmful, nor are they anti-social, but they must be considered when properly training the child. Irrational fears such as fear of the dark, closed doors, dental chairs, etc, are psychological and

* Summary of the Panel Discussion, Nov. 6, 1954 at Shore Club Hotel, Miami Beach, Fla., at the Annual Meeting of A.S.D.C. Participants: Dr. Granville Fischer, Professor and Head of the Dept. of Psychology, University of Miami, Miami, Florida. Dr. James Anderson, Practicing Psychiatrist, Miami, Florida. Dr. John C. Brauer, Dean, College of Dentistry, University of N. Carolina. Dr. George Teuscher, Dean, School of Dentistry, Northwestern University, Chicago. Moderator: Dr. Alfred E. Seyler, Editor, Journal of Dentistry for Children, Detroit.

† Adrian, Michigan.

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they may be conditionalized. In other words, training may overcome them.

Pathological fear, such as a situation in which a child might wet each time it was confronted with any fear would probably require medical or psychiatric treatment.

The feeling of security must certainly be considered as an important factor in child behavior. Security or the feeling of security definitely influences fear. Consider the child that is overprotected by his parents. Too much security most assuredly makes a problem. Some things must be left to the child to do for himself in order that his mental growth may be somewhat stabilized by a feeling of being able to do something for himself, or by himself. Examples may be the child's delight that he can dress himself, tie his shoes, and tell time, just to mention a few. Of course, some people have a natural feeling of security much more than others, but the parents' attitude toward the child's ability or desire for security has a most important influence on his actions and behavior.

Frustration, a common dilemma of the child in circumstances which are new to him is not uncommon. Frustration is sometimes the result of exhaustion and even occasionally the result of agitation and guilt.

Again we mention the dentist and his attitudes and responsibilities. He sometimes considers children as not a profitable business venture and very often through not having patience to understand the child does not make the child welcome because he knows the occasional child may upset his office routine. This may possibly be referred to as "child combat in the waiting room." The dentist may not wish the physical and mental exhaustion that may result from his not understanding and being able to cope with the child's actions. We can not expect the dentist to change the child's personality during the course of a short visit in the dental office. Consider the many mothers who may comment to their spouses about the exhaustion they feel after a normal day in the home with their own children!

Theoretically, human behavior is all motivated by the individual seeking some satisfaction or goal. However, many obstacles stand in the way. The obstacles are the problems that must be solved by the individual in order that he may again resume his travel on the desired pathways. Some children may be timid. Some may be aggressive, but if difficulties arise in settling problems, the resulting complications may be beyond his resources for solution, and again fright may be evident. Here again we see the possibilities of aggression and rage resulting in fear or flight because of the inadequacy of the individual experiences to deal with the present problem.

The emotional nature of fear is not a new brain reaction, but an old one. As previously stated, fear results when the person is unable to rationalize a problem. From the medical standpoint it must be seated in the autonomic nervous system. Now with this background we can comprehend that the unexpected or even more implicit, the suddenness of the unexpected does not allow for preparedness or self organization to deal with the situation, hence fear may be the likely result. Here again preparedness may allow the child to organize his resources to be better acquainted with the expected visit to the dental office. As the unfamiliar becomes recognized, there is bound to be less fear of the situation and less overall excitability.

We must have a good background in the theory of the problem before we can

have good practice in dealing with it so all the angers, loves, and fears are important. All emotional factors cannot be separated into grief, love, anger, fear and disappointment. A child has limitless expressions and can not be described under one label. Something very small in the beginning may be easily magnified at a later date. All associations with these experiences are influencing factors. Displeasures of the parents for example may be quickly associated with the dentist and his treatment. Time is on the side of proper training as a child's fears may appear and then wane with proper training.

The factors in the child's background both in and out of the home must be dealt with at times to help understand a child's problem. A plane of graded experiences is better than just letting happen what may. Here we can state that a friendly visit to the dental office to examine the waiting room and operating rooms and their contents may be a pleasant experience if the child finds familiar objects as well as new ones and is met in a friendly manner. Perhaps the next step should be a pleasant dental experience such as a dental examination and prophylaxis. If the first trip is made due to a tooth ache and usually in haste, the before-mentioned sudden, unfamiliar and probably frightening experience may result. This may be a difficult problem created by a parent who has not been properly conditioned to dentistry for children.

Fear should be channeled to easier things such as dental hygiene, proper diet, and at times can work towards social advantages.

Fear in the child may be overcome by confidence, sincerity and understanding. Everyone likes to be praised as well as recognized. Do not lose the opportunities to prove a friendship with the young people by understanding and sincere consideration of their childish interests.

The dentist must visualize the child not only as his present patient, but as his future patient as well. Actually the child is a challenge to the dentist's future.

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A Functional Space Maintainer and Guide for the Unerupted First Permanent Molar

HELMI R. FOGELS AND F. R. SHIERE*

THE purpose of this paper is to present a space maintainer which aids in the guidance of an unerupted first permanent molar into its proper occlusal relationship following the premature loss of the second primary molar. This condition results most frequently in a loss of space and therefore the use of a maintainer is indicated (1). (Fig. 1) This appliance is simple to construct, requires no surgical intervention, restores masticatory function, and maintains space.

It was the desire of the authors to maintain simplicity of design for this space maintainer. It consists of a single crown constructed for the first primary molar, an occlusal bar, and a saddle cast in one piece. This procedure eliminates soldering and gives more strength to the appliance. No preparation is necessary on the anchor tooth, except to relieve the contact or the bucco-gingival ridge in some instances. The posterior extension of the bar and saddle is determined by the prominence of the bulging tissue above and immediately anterior to the unerupted first permanent molar. Radiographs will aid in locating the limit of the extension in cases of very young children. The saddle, which rests on the tissue, must not be over-extended bucco-lingually in order to prevent impingement on the adjacent tissues. The design of this appliance excludes surgical procedures, necessary for other types of space maintainers, under similar conditions.

From the Department of Oral Pediatrics, Tufts College Dental School, Boston 11, Massachusetts.

The morphology of the first primary molar presents difficulties for good band adaptation, therefore it seemed more advantageous to construct a full cast crown. This method offers superior retention, suitable protection against caries and eliminates re-cementation. The thickness of the crown on the occlusal surface is kept at a minimum and results in only a slight opening of the bite. This increased vertical dimension re-adjusts itself without pain within a short period of time, due to the adaptability of tissues in young children.

The bar is positioned in balanced occlusion with the antagonistic teeth. This prevents torque forces from being exerted on the appliance, which results in the premature resorption of the roots of the first primary molar. The bar also serves as a food platform for masticatory function, and hinders the supra-eruption of the opposing teeth.

The saddle contributes to the balance of this appliance, prevents bending or rotation, and distributes the forces of mastication over a large area. Under intermittent masticatory forces and in conjunction with the broad surface contact area over the tissues, this saddle guides the first permanent molar into its proper relationship.

The space maintainer prevents anterior drifting and tipping of the first permanent molar and continues to hold the space necessary for the second bicuspid, following the eruption of the permanent molar. It can be maintained in position until the roots of the first primary molar are

FIG. 1

cedure is to make an amalgam die which is allowed to set overnight. This die is tapered, inserted into the plaster impression, and held in place with a few drops of wax. The impression is poured in yellow stone after applying diluted liquid soap as a separating medium. After setting, the stone model is separated from the plaster impression, the wax bite placed in position, vaseline applied, and the other half of the model poured.

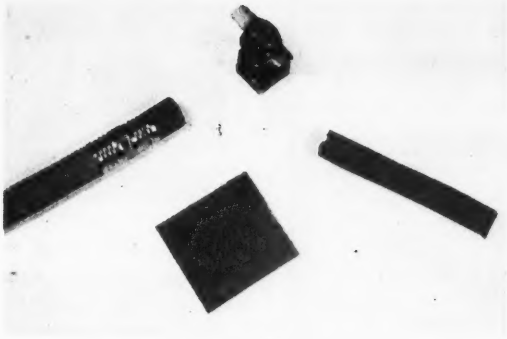

FIG. 2

normally resorbed and the tooth exfoliated.

CLINICAL AND LABORATORY PROCEDURES

The clinical procedure is as follows. A copper band is scribed and adapted slightly oversize to the anchor tooth. The band is filled with warm stick compound and forced to place. The compound is chilled with cold water, the impression removed, dried, and inspected for exact duplication of the margins and the occlusal surface. A plaster impression is then taken of the anchor tooth and the edentulous area. Finally, a wax bite is taken to provide the proper relationship with the opposing arch.

The first step in the laboratory pro-

After the amalgam die is lubricated, a square of soft green 28 gauge sheet wax is adapted with an eraser or pointed art gum to the occlusal surface. Two cuts are made mesially and distally to this surface and the excess trimmed. (Fig. 2) The wax is then adapted closely around the axial walls. Hard blue inlay wax is then used to reinforce the corners, the gingival margin, and the tips of the cusps. (Fig. 3) This procedure strengthens the wax pattern. An 8 gauge one-half round ready-made wax shape is used in the construction of the pontic, while a 15 gauge one-half round wax shape is selected for the saddle. It may be necessary to add additional wax to reinforce the pontic. The pontic is constructed so that it is

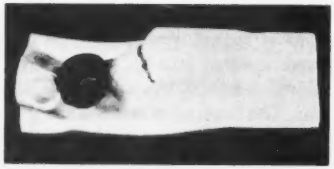

FIG. 3

FIG. 4

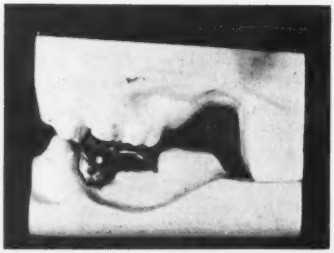

FIG. 5

FIG. 6

self cleansing, while the saddle rests on soft tissue. Finally, the wax is softened and the models occluded.

The wax pattern is then sprued at the junction of the crown and pontic, while 18 gauge wax shapes are used as auxillary sprues. The pattern is washed with green

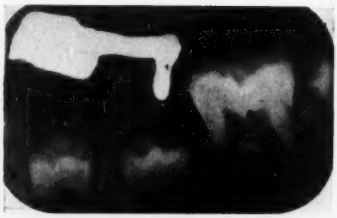

FIG. 7

FIG. 8

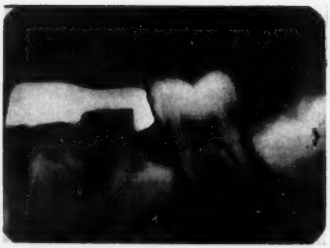

FIG. 9

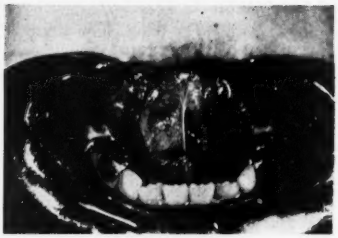

FIG. 10

soap, invested, and cast in a medium hard gold. The appliance is finished, polished, and cemented to place. (Figs. 4 and 5)

Results

This paper presents a study of twenty cases utilizing this appliance over periods of time from two to five years. The earliest placement of this space maintainer was at four years of age in which case the permanent molar was situated low in the body of the mandible. (Fig. 6) Another case (Fig. 7) shows the appliance after it had been placed at five years of age. Figure 8 demonstrates the appliance after it had been in the mouth for one year. The first permanent molar is partially erupted into its correct position. Figure 9 shows the same case with the x-ray taken before exfoliation, (3—years after the initial insertion), in which the roots of the first primary molar are completely resorbed.

Figure 10 illustrates the use of the appliance bilaterally in which case the first permanent molars have erupted into their proper relationships following the early loss of the second primary molars.

Summary

An appliance has been developed which has proven to be advantageous in guiding an unerupted first permanent molar into occlusion, following the early loss of the second primary molar. It fulfills all of the requirements for an adequate space maintainer. It restores masticatory function and prevents supra-eruption of the opposing teeth. It is simple to construct, eliminates surgical procedures, and is not harmful to the tissues.

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Premedication for Difficult Children

MANUEL M. ALBUM, D.D.S.

DENTISTRY for the apprehensive child, the difficult-to-manage youngster and the handicapped patient, has at times been difficult to perform by the dental practitioner in his office routine.

At times, the forceful approach by the dentist and his staff can do much to increase the psychic trauma to the hard-to-manage child as well as to produce long lasting injurious effects to the patient. Ruble is quite correct in his assertion that a screaming child can unnerve the dental staff and make a simple operation become a tedious and difficult one. (1)

The answer to this problem lies in the pre-medication of the child prior to dental procedures. However when dealing with pre-medication one must have the proper approach as well as the correct interpretation of the drugs used to successfully solve the issue at hand.

This paper will deal with barbiturates, Demerol, Thorazine, and Tolserol as well as their various combinations. The background of the drugs, the dosage, metabolism, and methods of administration will also be discussed.

In our desire to pre-medicate apprehensive and difficult children, we are interested in accomplishing one result—namely—the complete sedation of the patient. This statement carries with it a wide-range safety factor which heretofore has never been fully understood or correctly interpreted.

Barbiturates act by depressing the central nervous system. The degree of depression depends on the barbiturates used as well as its dosage. We read terminology such as narcotic, hypnotic and sedative; and sometimes we confuse the issue by using or implying the wrong description for our drug of choice. (2)

A narcotic drug in therapeutic doses produces analgesia with a reduction in awareness leading to deep sleep or stupor. By a hypnotic, we refer to a substance which will produce natural sleep. A sedative produces a reduction in mental awareness short of that required to induce sleep; but sufficient to have a calming effect which is desirable.

METABOLISM OF BARBITURATES

We are interested in the absorption, distribution in the tissues, the various areas of degradation, excretion and metabolic fate of the drugs. In the work of Maynert, consideration of excretion and metabolic fate was limited to those barbiturates which received chemical use or were closely related to such drugs. (3) Studies of the effect of stimulants, diuretics and possible metabolic inhibitors on the metabolism of the barbiturates were beyond the scope of Maynert's paper.

Many studies which were done on the excretion of the barbiturates in the urine, contain no data on the adequacy of extraction or the purity of the final product. With proper technique, the cobalt color method is suitable for the study of the concentration of barbital in body tissues and fluids under conditions of usual dosage. On the other hand, this method has been shown to yield erroneous results when used to study barbiturates which are degraded in vivo. (4). Koppanyi found that 5–41% of the doses of Neonal and 8% of the doses of Amytal are excreted in the urine. (5) Herwick and Shonle using chemical isolation and pharmacological methods, showed these substances are

excreted only in traces. (6, 7) Isotopic methods which Van Dyke and co-workers did in examining the excess N^{15} in urinary ammonia and urea after oral administration of pentobarbital labeled with N^{15}, found that less than 8 % of the isotope was contained in these fractions. (8) The amount of the unchanged drug and the metabolites can be determined with precision by the isotope dilution, but the expense and special equipment makes the every day practice of barbiturate determination impractical.

Absorption and distribution in body fluids occurs quite readily from the gastrointestinal tract according to Weese. (9) A considerable part of the dose can be absorbed from the stomach and narcosis can follow intragastric administration to guinea pigs with a ligature around the pylorus. Most authors agree that rectal administration of the barbiturates is much more efficient than the oral route. This avoids immediate passage through the liver which is the most important organ in degrading all but a few of the barbiturates. Weiner, Pratt and Tatum using rabbits found the ratio of the oral to the intravenous LD_{50} was 15:1 or more for the sodium salts of thiopental, Thioethamyl and Evipal, whereas the corresponding ratio of rectal to intravenous doses was 2.2 to 3.1:1. The oral: intravenous LD_{50} ratio of a larger acting barbiturate, sodium pentobarbital, was 6:1, and the rectal:intravenous LD_{50} was 1.4:1. (10) It would be expected that sodium barbital, which undergoes virtually no destruction in the liver or other tissues, would be found to differ little in potency by all three routes. The intravenous administration does produce a delayed latent period of action of barbital due to the delayed equilibrium between plasma and nervous tissue. Bennhold with Evipal came to the conclusion that plasma albumins and globulins bend the drug when it is transported intravenously. (11)

Except for barbital, which undergoes no degradation in the body, the relationship of estimated blood level to pharmacological effect has to be accepted with caution since the majority of methods or techniques do not actually distinguish between the administered barbiturate and metabolically altered derivatives which at present seem to be barbiturates. (12) Traces of Nembutal and Seconal can be found in the blood levels even after 24 hours.

It should be noted that the blood level of barbital does not always reflect the level in the central nervous system.

Destruction in the Tissues

After the barbiturates are absorbed, they probably enter all the cells and are concentrated in some tissues such as the liver and the kidneys. This is shown by the appearance of barbital in gastric juices and pancreatic secretion (13) and in the fetal tissues. (14, 15) It is possible that equilibrium, however unstable, is achieved more quickly for short-acting barbiturates than for long-acting drugs, especially barbital with its long latent period of action.

Detoxification depends upon renal excretion or destruction in the tissues or both. Barbital is the only barbiturate which seems to leave the body with alteration and its detoxification depends entirely on renal excretion which may extend over days. (16) Excretion may be reduced by renal diseases. (17) Phenobarbital is mostly degraded in the body in some unknown fashion. Functioning kidneys are necessary for its detoxification. (18) To date it has not been adequately demonstrated that kidneys play an essential part in the detoxification of the other barbiturates.

The most important other single organ

for detoxification is the liver. The liver inactivates thiobarbiturates like thiopental so efficiently that extensive reduction of functional hypnotic tissue is necessary before the liver's importance in this regard can be revealed.

Excretion and Metabolic Rate

The body possesses these methods for the removal of barbiturates (1) Destruction or chemical alteration in the liver, (2) excretion through the kidneys and (3) the reticulo-endothelial system.

The fate of a particular barbiturate depends on its chemical concentration; but one cannot predict from its chemical structure how the drug will be metabolized. It has been found that in some instances it took a period of 5 days to excrete 70% of the barbital. Only very small amounts of pentobarbital are eliminated in the urine. (19) Nembutal and Pentothal are eliminated either through the kidney and then the liver if necessary. As far as Seconal is concerned, not much is known about its metabolism and it is probably eliminated through the reticulo-endothelial system. Pentothal is given off at the rate of 13% every hour. Nembutal is given off at a little slower rate.

Circulation

We have found thet following the administration of Seconal and Nembutal, there is a 10–15 mm. drop of mercury in blood pressure readings. However the same drop occurs when an individual is asleep. (20) Therefore, the drop in mercury may be due to the relaxation of the patient.

Dosage

Dosage depends on many factors and with proper evaluation, adequate premedication can be obtained. We must realize that children because of their basal metabolic rate and unstable nervous systems require more sedation for effectiveness than an adult individual. The age period from 2 years to 10 years is a period when a high dose is required for effectiveness. This is due to the growing stature of the child. Children during this period use up tremendous amounts of energy and are always on the go. From 10 years until 15 years there is a levelling off of the metabolic rate and after 15 years, the dose is decreased in order to obtain effectiveness. In other words, the dosage used on a 2–10 year old to produce proper results would be too much when given to an adult of 35–50 years of age. Another factor to be considered when applying dosage is the degree of apprehension in the child. A highly nervous individual will require a larger dose than normally given. In the handicapped child with cerebral palsy, mental retardation, the amount of brain damage determines the dosage needed for proper results. If there is a severe amount of destruction to the brain the dose normally used would not be very effective. The dosage in these cases is determined by the initial visit which is really a fact finding visit designated to obtaining the effective dosage for that individual.

Some patients may be on drug therapy and in these instances, it is quite difficult to obtain adequate results. It may be necessary to go into high doses which are not always effective or else apply another form of medication.

Goldstein states that the average dose to produce sleep does not depress respiration, but that large doses can cause death by respiratory failure. (21) This is true but first we must determine what is considered an average dose and a large dose. And again we are not dealing with suicidal doses which the patient might take, but those prescribed by the practitioner.

Infants past 3 weeks of age can consume

twice the amount of an adult dose and yet not produce injurious effects. There is in reality a wide margin of safety in the administration of the barbiturates.

One of the faults in not obtaining true sedation in a child patient is the insufficient initial dose. In pre-medicating children you can not utilize any of the so-called standard rules or formulas. If the practitioner adheres to any one of the common formulas, he will not acquire the true result he is striving to reach. One must establish a minimum dose for every individual and then work from there. The axiom that I have used in my study of sedation over a 4 year period involving several hundred patients is simply this—it is easier to add to sedation than it is to withdraw. Once you have given an exceedingly high dose without any previous dosage background of the individual, you may be administering more than is necessary. In every case we must establish what is considered to be the effective dose for that individual. Almost every patient we have sedated, has the same initial starting dose, from 2½ to 3 grains of the barbiturate. It must be remembered that the barbiturates produce hypnosis but do not remove pain. A dose of the barbiturates given to carry out x-ray examinations is effective but the same dose to perform a pulpotomy will not produce a very cooperative patient. Consequently when actual dentistry is contemplated, it is wise to combine a barbiturate like Seconal or Nembutal with Demerol. Each has a synergistic action with the other. Thus we produce hypnosis and the removal of pain at the same time. The dental work will proceed on a smoother keel. The dose of Demerol is calculated according to the body weight of the patient and when used in combination with the barbiturates, the initial determining dose of Demerol should be around 25 mgm. It may be necessary to give larger doses but this can only be ascertained after the determining initial dose and through experience.

A child of 2 years was given 2½ grains of Seconal and 25 mgms. of Demerol to do a pulpotomy. Without the barbiturate, when given just Demerol alone, the child was giddy and walked around with a "jag". The work attempted was not too effective during this initial visit. Demerol by itself does not produce a patient that is completely out and suitable for treatment. It must be used in combination with a barbiturate for effective results. The above dosage of Seconal and Demerol on the second visit enabled us to do a successful pulpotomy.

The effectiveness of a barbiturate such as Seconal and Nembutal occurs at the end of 1 hour. Demerol also reaches its peak during that time. If at the end of an hour nothing has happened, it is permissible to give the child a second dose which is less than the original dose of the barbiturate and Demerol. For example, an initial dose of 2½ grains of Seconal or Nembutal and 25 mgm. of Demerol is administered to a 3 year old youngster weighing 25 pounds. At the end of an hour nothing has happened. An additional dose of ¾ grain of the barbiturate and 12 mgm. of Demerol should be given. The sum total of these two doses should be the starting dose for the second visit. In some instances it may not be possible to obtain satisfactory results and each case must be determined according to the circumstances surrounding the individual child patient. Thus each case is an entity in itself and should be developed accordingly. However, following the rule of sedation that I have used on my patients for determining from their initial visit, the dosage applicable to that individual, our results have been very effective and successful. Determining dosage in

this fashion is safe on the part of the patient and the practitioner.

The instances where the correct dosage is difficult to obtain are in those children who have taken one of the barbiturates over a long period of time and developed a tolerance to that type of barbiturate. When the patient is switched to another barbiturate, he may develop a cross-tolerance to any form of barbiturate. In these cases, the child should be switched to another form of sedation or else taken off all medications and discharged for a period of several months before further dental work is attempted. Case History V exemplifies this tolerance and cross-tolerance to the barbiturates.

When pre-medication is given to a child the parent must be informed that the patient should be put to bed and that he will sleep for the rest of the day and perhaps through the night. After the youngster awakes, he may have a slight drunken appearance which will disappear in time. It usually takes from 24 to 48 hours to throw off the effect of the sedatives used by the dentist. Children should always be accompanied by an adult, since it will be necessary to carry them home following the dental work.

A word should be said concerning those cases where the child becomes highly excitable following sedation. This is the result of an insufficient initial dose and after a form of sedation has been obtained the patient may again pass through an excitability stage while the drug is wearing off. Idiosyncrasies to the barbiturates are rare. Lampshire reports two cases of idiosyncrasy in his patients. (22) This reaction may take the form of urticaria and will disappear following the elimination of the barbiturate.

Barbiturates can be administered in the following manner: orally, intramuscularly and rectally.

The oral route is in the form of a capsule or an elixir. Some children, particularly certain handicapped children, can not swallow capsules. In these cases, the capsule should be opened and embedded in a teaspoon of baby fruit. Custards do not make a suitable vehicle, as they have a tendency to produce vomiting. If the above is not possible, the rectal administration may be used. The elixir form of the barbiturates is not practical nor suitable since it requires much too much in order to obtain the minimum dose for sedation. Children will not tolerate the taste of the elixir or the quantity deemed necessary. When the child can swallow a capsule, faster results will be obtained if both ends of the capsule are pierced. This will produce faster absorption.

Barbiturates given through the intramuscular route can be used in very, very young children where large doses are not necessary. Each cc. of Nembutal used contains ¾ grain of the barbiturate. Actually it is unwise to give more than 2 cc. of Nembutal by this method, since the Nembutal produces a burning sensation at the site of the injection. One cc. of Nembutal, intramuscularly, produced effective results when given to a 1 year old youngster for x-ray studies of the maxilla and mandible. On a repeat visit a month later, it was necessary to give 2 cc. of Nembutal, equivalent to 1½ grains. If a larger dose is necessary, it would be more practical to use the rectal form of administration.

Demerol should be given intramuscularly to be effective and its dose should be calculated according to the body weight of the child. Demerol when used as part of the pre-medication sedation will not produce vomiting as will morphine.

Nembutal or Seconal can be given rectally in those cases where it is impossible to use any other form of administration. In this instance it is advisable to

pierce both ends of the suppository capsule for faster and more effective results. When using the rectal route of administration the patient should receive an enema the previous night. This will cleanse the lower bowel and prevent the suppository from becoming lodged in fecal matter and not producing any results. This is the reason why some men do not obtain satisfactory results. The presence of the fecal matter will prevent immediate sedation and additional suppositories should not be given as it is possible in this fashion to produce a delayed reaction later on.

I prefer Seconal to Nembutal since it dissipates itself in a shorter period of time after it achieves its end result.

Noctec or Chloral Hydrate has proved effective for pre-operative sedation in tonsillectomies but has not proved to be too effective for dental treatment. The same may be said about Paraldehyde.

Thorazine is a new therapeutic agent with a wide spectrum of pharmacodynamic activity. (23) It affects the central and autonomic nervous system. It can be said that Thorazine performs a chemical pre-frontal lobotomy. It has been used effectively in mental disturbances, control of vomiting, hiccups, relief of pain, etc. Thorazine prolongs and intensifies the action of central nervous system depressants such as barbiturates and narcotics. Thus, the barbiturates and Demerol should be reduced in dosage ¼ to ½ when used with Thorazine. Again in determining the initial dose for a particular patient it is advisable to begin with 25 mgm. (1 cc.) of Thorazine, in addition to the reduced dosage of the barbiturates and the Demerol. Thorazine may be the answer for the cases that fail to respond to barbiturates. Patients should lie down following the administration of an intramuscular dose 9f Thorazine as it produces hypotension. This is a transient reaction and usually disappears by the time the patient is ready to leave the office. Thorazine produces dryness of the mouth, as will Demerol in some cases and can be a useful asset to the dentist in maintaining a dry field of operation. The drug has much to be said for its use in the field of dentistry and further study will determine its effectiveness.

TABLE A

Suggested preanesthetic medication

Age (years)	Weight (pounds)	Demerol (mg.)	Pentobarbital Sodium* (gr.)	Scopolamine (gr.)
2 to 3	25 to 30	20	½	1/400
3 to 5	30 to 40	25 to 30	1	1/300
5 to 8	40 to 55	35 to 40	1	1/300
8 to 10	55 to 65	50	1½	1/200
10 to 12	65 to 80	50	1½	1/200
12 to 14	80 to 110	75	2	1/100
Over 14	110	100	2	1/100

* Pentobarbital sodium is useful in very apprehensive children, but may be omitted.

Tolserol has proved to be very effective in relieving apprehension with difficult patients. (24, 25) The Elixir of Mephenesin (Tolserol) and the Suspension Tolserol Carbamate are two vehicles that will produce effective results. Tolserol is a muscle relaxing agent and by itself does not produce any hypnotic or sedative effect when given in prescribed doses. The elixir and the suspension are more effective than the tablet form of Tolserol and produce results in approximately 85 per cent of the cases where used. The dosage for the suspension carbamate of tolserol is 1 teaspoon per 50 pounds of body weight. The suspension may be given in combination with a dose of the barbiturates to do certain phases of dentistry.

The barbiturates can be given in combination with chloral hydrate and paral-

dehyde where necessary to do minor dental procedures involving little pain.

Barbiturates, such as Nembutal can be given in combination with Demerol and Scopolamine for pre-operative sedation as part of a general hospital anesthetic procedure for dental work. The table A from Album and Deming's article on General Anesthesia for the Handicapped Patient, shows the doses given for the various age and weight groups. (26)

A few words might be said concerning the possibility of respiratory failure arising from the use of barbiturates. It would be wise to have on hand, central nervous system stimulants such as metrazal, benzedrine, benzedrine and caffeine, and ephedrine sulphate. An antidote for Demerol is Nalorphine hydrochloride. (27) Death after a toxic dose of barbiturates is due to respiratory and vasomotor failure or to the effects of these actions.

Barbiturates should be used on those individuals who develop an idiosyncrasy for any of the local anesthetics. (28)

In toxic doses, and then again we must think in terms of suicidal doses, it is said that the barbiturates stimulate the pituitary and adrenal glands. (29)

Conclusion

Proper pre-medication for the dental treatment of difficult and apprehensive children will produce successful results. Pre-medication to be effective should consist of a combination of one of the barbiturates and Demerol calculated according to the formula described in the article. When necessary, other medications may be added in the initial dosage administration.

By following the rules laid down, we will accomplish for the most part, absolute sedation of our patient, observe the safety factor, and at the same time complete the required dentistry. The exception to this is in the small number of patients who develop a tolerance or cross-tolerance to one of the barbiturates. When this happens, it becomes necessary to establish an initial satisfactory dose for another form of medication.

Case Reports

The Case histories presented, describe the routine results obtained through premedication as well as to show some of the unexpected difficulties that might confront the dental practitioner.

Case I

J. L., a 2 year old female, normal, weighing 25 pounds, requiring a pulpotomy in the upper left primary central incisor. She was sedated at 1:50 P.M. using Seconal (2¾ grains) mixed into a teaspoon of applesauce. Demerol (20 mgm.) was given intramuscularly in the buttocks. The patient was asleep at 2:40 P.M. Xylocaine was infiltrated in the tissues over the involved tooth and a pulpotomy was successfully performed. Patient returned home where she slept for five hours before awakening. She was unsteady on her feet and returned shortly to sleep throughout the night.

Case II

J. D., a 6 year old male, central nervous disorder, weighing 30 pounds, requiring impressions for the preparation of a "jump plate". He was sedated at 1:15 P.M. with Seconal (3 grains) in a teaspoon of applesauce, and Demerol (25 mgm.) intramuscularly. At 1:50 P.M., the patient was sound asleep and alginate impressions of both jaws were taken without any difficulty.

Case III

C. K., a 7¾ year old female, mentally retarded, weighing 67 pounds, requiring examination and prophylaxis. At 8:35

A.M., the patient was given Seconal (3 grains) orally by capsule and Demerol (75 mgm.) intramuscularly. A slightly higher amount of Demerol was used to compensate for the child's nervous activity and apprehension. At 9:35 the patient was not asleep. She was given an additional dose of Seconal (½ grain) orally. At 10:00 A.M., she was completely asleep. X-rays were taken and prophylaxis was performed successfully.

Case IV

B. M., a 9 year old male, normal, but very apprehensive, weighing 85 pounds, requiring routine dental work. At 9 A.M. sedated with Nembutal (2½ grains) orally by capsule, and Demerol (80 mgm.) intramuscularly. At 10 A.M. no reaction. Given additional dose of Nembutal (¾ grain) and Demerol (25 mgm.). Patient worked on at 10:30 A.M. successfully.

Case V

J. L., a 14 year old male, mentally retarded, weighing 75 pounds, required extensive dental work. He presented a picture of an uncontrollable, screaming youngster. Sedated with Seconal (4 grains) orally by capsule and Demerol (50 mgm.) intramuscularly, excellent results were obtained within an hour and routine dental procedures were performed successfully. This dosage was given once a week for 3 weeks without any difficulty. On the fourth visit, he was given Seconal (4½ grains) and Demerol (50 mgm.). At the end of an hour, patient was not asleep. Given additional dose of Demerol (25 mgm.). Patient out 25 minutes later and worked on. At the fifth weekly visit, the patient was given Nembutal (4½ grains) and Demerol (75 mgm.). He was not completely asleep an hour later; given additional dose of 25 mgm. Demerol. Asleep in 10 minutes and then fully awake. No work was done and the patient was sent home. On the patient's sixth weekly visit, the sedation was switched back to Seconal (5½ grains) and Demerol (75 mgm.). At the end of an hour patient would be asleep then abruptly wake up. He was given an additional dose of Demerol (50 mgm.). In about 15 minutes he was asleep and dentistry was done.

The boy was given a dose of Seconal (6 grains) and Demerol (90 mgm.) at the seventh visit. He was still awake an hour later. An additional dose of Demerol (30 mgm.) was administered. Ten minutes later the patient was asleep and worked on. This case is most interesting since it shows the development of a tolerance to the barbiturates, as well as a cross tolerance to any form of the same family. The patient was discharged at the end of his last visit and no further work will be done on him for four or five months, until all traces of the barbiturate has been eliminated from his system. He will be placed on a combination of other medications when he returns for treatment.

The side reactions which occurred as a result of insufficient dosage and tolerance during the last few visits were most fascinating. The boy ranted, screamed scratched his arms and face drawing blood, and banged his fists against the sides of his head. Although symptoms such as these are not common, it does demonstrate the excitement stage that patients may pass through as the result of insufficient dosage.

Case VI

J. K., a 10 year old male, mentally retarded, weight unknown, was admitted to the hospital for operative dentistry. Chest x-rays and lateral plates of the jaws were ordered for the child as part of his physical work up.

He was given Nembutal (3 grains)

in order to take the x-rays. Nothing occurred at the end of the required waiting period. A dose of Chloral Hydrate (7 cc.) was injected intramuscularly. No results showed at the end of a ¾ hour period. Six cc. Paraldehyde was divided into two equal doses and injected into each buttock. Two hours later he was asleep enough to take x-rays of his jaws and chest. The following morning he was sedated for his operative work with Nembutal (1½ grains); Demerol 50 mgm. and Scopolamine 1/200 grain.

The patient was seen at the dental office five days later and given Nembutal (3 grains) orally by capsule, and Thorazine (25 mgm.) intramuscularly in the buttocks. At the end of an hour he was unsteady on his feet and was given Demerol (25 mgm.) intramuscularly.

He was fast asleep on the sofa and his mouth was examined without any trouble. As soon as he was transferred from the sofa to the dental chair, he awoke and was quite reactive. Since we were using a new combination of drugs we had to establish our fact-finding dosage. The patient was discharged and at the next visit he will be given a higher concentration of the Thorazine and Demerol, and all three drugs will be given at once in order to produce sedation.

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Anomalies of the Primary Dentition

LEONARD F. MENCZER, D.D.S., M.P.H.

THE primary dentition holds a fascination of its own and the dentist who practices for children and renders them dental health service finds his many rewards.

A case in point may be the observation of dental anomalies (aberrations) amongst the primary teeth. The cause of these anomalies is thought provoking and an item of interest rather than of profound consequence in either the primary or the permanent (succedaneous) dentition. The most frequent anomalies which manifest themselves in primary teeth are:

1. Anodontia (missing teeth)
2. Supernumerary teeth (excessive number of teeth)
3. Fusion of teeth

These three categories of anomalies, primarily, will be discussed below.

Dental anomalies of the primary teeth are not frequent since out of 2,209 clinical examinations of pre-school children at the Hartford Pre-School Dental Clinic (ages two through six) during 1952, only a total of eleven such occurrences have been observed and radiographically recorded—an incidence of 0.5%.

As a group, aberrations among primary teeth are less frequent than similar anomalies in the permanent dentitions (with the exception of fused teeth). It has been reported (1) that from a large number of cases studied: 2.7% had congenitally missing permanent teeth; 0.9% had supernumerary permanent teeth.

The fusion of permanent teeth is a rare occurrence and though reported in the literature, no statistics are available on its incidence.

ANODONTIA

Anodontia may be complete or partial; that is, the total absence of all teeth or the absence of one or more teeth. It results from a lack of initiation or from an arrest in proliferation of cells of the basal layer on the epithelial border of the embryonic jaw (2). Some investigators attribute the absence of permanent maxillary lateral incisors (the most frequently missing teeth) as the result of injury to the tooth germ during development. Since this germ is found immediately beneath the palatal plate, it is sometimes injured and therefore does not develop.

Our study revealed that only 0.09% of the patients observed (in comparison to 2.7% for permanent teeth) manifested missing primary teeth (two out of the eleven anomalies mentioned above), Figures 1 and 2.

Congenitally missing permanent teeth are usually limited to the lateral incisors while next in frequency are the permanent mandibular second bicuspids.

The value of a patient's history is clearly demonstrated when one considers Figure 3. Here we see what appears to be a missing left mandibular central incisor; however, on interviewing the parent, it was learned that the child was born with $\overline{A}$ already erupted (natal tooth) and at age three months the tooth loosened without undue trauma and was exfoliated. Figure 4 is a radiograph of that primary $\overline{A}$ which the parent retained and which was brought in at the writer's request. The crown of this tooth was chalky yellow in appearance and normal in shape and size. Because of its early eruption, it was

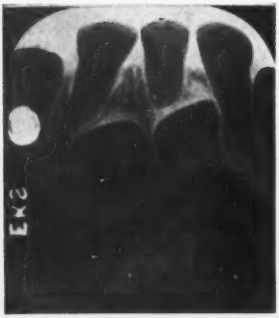

FIG. 1. Child age 3 years 4 months, missing left mandibular lateral incisor.

FIG. 2. Child age 4 years 2 months, missing right maxillary primary lateral incisor.

FIG. 3. Child age 4 years 3 months, missing left mandibular central incisor; actually premature eruption and early loss. Note advanced stage of eruption of $\overline{|1}$ in comparison to $\overline{1|}$.

FIG. 4. X-ray of primary $\overline{|A}$ erupted at birth and exfoliated at age 3 months. Note lack of root and rather transparent quality of crown to x-ray.

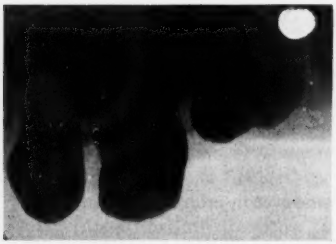

FIG. 5. Child age 4 years 1 month, unerupted right maxillary primary second molar.

without root and understandably easily loosened and exfoliated.

The crowns of primary mandibular centrals are usually completed at around 2 to 4 months (post natal) and the average eruption time is 5 to 7 months. Root completion for these teeth is usually 1½ to 2 years of age.

The value of x-rays in conjunction with clinical examination is demonstrated in Figures 5, 6, 7. In these instances, the clinical examination revealed the absence of the right maxillary primary second molar (Figure 5); and the absence of the right and left maxillary primary second molars ($\underline{E|}$ $\underline{|E}$) (Figure 6 and 7). In both cases, since these children were 4 years 1 month of age, and 3 years 10 months of age respectively, it might be assumed that these teeth were congenitally missing or had been extracted at an earlier date. However, radiographic examination in both instances revealed, unerupted maxillary primary second molars. The younger

FIG. 6. Child age 3 years 10 months, unerupted left maxillary second primary molar.

FIG. 7. Child age 3 years 10 months, unerupted right maxillary second primary molar.

child was seen again three months later at which time the mesiobuccal cusp of E had partially erupted and was clinically visible, while E was still submerged.

Since the usual eruption time for second primary molars is from 18 to 24 months of age, these unerupted teeth may be considered as being beyond the upper limits of normal eruption.

SUPERNUMERARY TEETH

Supernumerary primary teeth although relatively uncommon, have been found to occur, in this study, more frequently than missing primary teeth. Of the eleven anomalies reported, five are of supernumerary teeth and four of these

FIGS. 8, 9, 10, 11. Supernumerary right maxillary primary lateral incisors.

FIG. 8

FIG. 9

have been found to occur on the maxillary right side (Figures 8, 9, 10, 11). The fifth was located in the right mandibular jaw (Figure 12).

Supernumerary permanent teeth, like the primary supernumeraries, usually occur in the maxilla but, for the most part, they are conical and rudimentary in form and most often located between the permanent centrals (erupted or impacted). As seen in Figures 8 through 12,

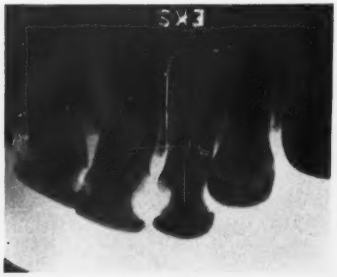

FIG. 10

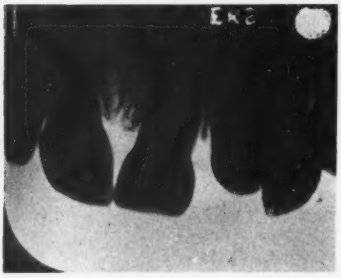

FIG. 11

unlike the permanent supernumerary, the primary supernumerary is found in the lateral incisor regions and assumes the normal size and shape of primary laterals, and, for that reason, frequently goes unnoticed.

It is held "that supernumerary teeth develop as a result of continued growth of unresorbed areas of the dental lamina in the interspaces between developing teeth" (1). Kronfeld stated that supernumerary teeth "are apparently the result of an atypical overactivity of the dental lamina. In other cases, it seems that their development might be some form of atavism . . . namely, a recurrence of the third incisor that has been eliminated early in the development of the human race" (3).

FIG. 12. Supernumerary right mandibular primary lateral incisor.

FIG. 13. Fused right mandibular primary lateral incisor and cuspid.

FUSION OF TEETH

Fused teeth are defined as two or more teeth which are structurally united, their germ having developed in the same sac (4). Their occurrence is the result of some irregularity in the tooth germs—a union of the germs occurring during the de-

FIG. 14. Fused left mandibular primary central and lateral incisors.

FIGS. 15 and 16. Bilateral fusion of mandibular primary lateral incisor and cuspid.
FIG. 15

FIG. 16

FIG. 17. Fused right maxillary permanent central and lateral incisor ($\overline{2.1}$). (Courtesy of Dr. M. Niekrash).

velopmental process. In this study, 3 of the 11 anomalies manifest this occurrence and all in the mandible, Figures 13, 14, 15, 16.

Fused primary teeth are in no way indicative of succedaneous trends; that is, the permanent dentition that replaces these fused teeth usually are normal in shape and number. In the writer's experience fused primary teeth are of much more frequent occurrence than fused permanent teeth (unlike other anomalies reported herein), since in his experience, having examined more than 15,000 school-age children, he has never seen a fused permanent tooth. The latter do, however, exist as shown in Figure 17.

In passing, "concrescence" may be mentioned—a term used to denote the fusion of roots only, the crowns being separate and distinct. The concrescence

FIG. 18. Enamelomas removed from the occlusal surface of left and right mandibular permanent first molars.

theory advocated by Bolk is that a complex tooth represents the concrescence or coalescence of successive germs belonging to the same dental family (1, 4, 5). Concrescence of primary teeth has not been observed in this study.

MISCELLANEOUS

Of passing interest is Figure 18 depicting what appears to be two enamelomas (embryonic tumors of enamel tissue).

These enamelomas were chiseled from the occlusal surfaces of the right and left mandibular first permanent molars of a child age 6 years 1 month.

As far as could be determined clinically and radiographically these molars were otherwise normal. Clinically, only the mesial cusps were visible and the enamelomas were for the most part submerged beneath the gingival flap covering the yet unerupted mandibular first permanent molars. The attachments of the enamel tissue were to the fissures of the occlusal surfaces. In all likelihood, this enamel tissue would have been crushed when the maxillary and mandibular molars came into occlusion and this rather rare occurrence not observed.

SUMMARY

1. Eleven dental anomalies have been observed in 2,209 pre-school children at the Hartford Pre-school Dental Clinic during 1952.

2. Dental anomalies in the primary dentition such as: missing teeth, supernumerary teeth and fused teeth are of infrequent occurrence and with the exception of the fused teeth they occur even less frequently than similar anomalies in the permanent dentition.

3. Because these anomalies are marked deviations from the normal standard they are of interest, worthy of noting and deserving of further investigation.

4. Dental anomalies amongst the primary teeth are not indicative of trends in the succedaneous dentition. In other words, a missing, a supernumerary or a fused primary tooth is seldom followed by a similar occurrence in the permanent dentition.

5. The value of the x-ray and patient history as adjuncts in diagnosis is demonstrated. In the absence of these diagnostic aids, erroneous conclusions may be drawn.

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